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# ENGINEERING AND MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

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## The Cyprus Mines Enterprise

By V. G. Hills

*A Historic Property Under American Control*

## Microscopic Study of a Copper Ore

By R. E. Head

*Intelligent Selection of a Leaching Method*

## Treatment of Telluride Concentrates

By J. T. Willey

*Bromocyanide Used by Wright-Hargreaves*

## When the Small Mine Pays

By George J. Young

*Conditions That Mean Success or Failure*

## A Prospector's Quicksilver Plant

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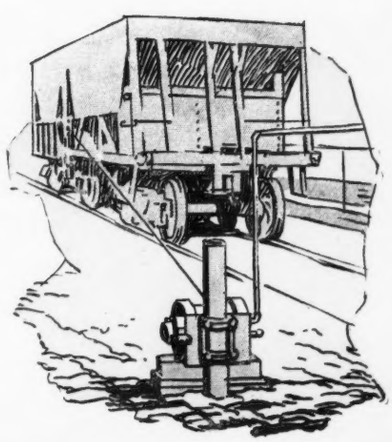

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*ENGINEERING & MINING JOURNAL* has prepared a backing sheet for use when typewriting, containing suggestions to authors. A copy of this will be sent on request.

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# MINING JOURNAL

*McGraw-Hill Publishing Company, Inc.*
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## *Engineering and Mining Journal*

*Engineering and Mining Journal* was founded in 1866 as the *American Journal of Mining,* with George Francis Dawson as Editor. In 1869 the name was changed to *Engineering and Mining Journal.*

Publications which have been absorbed are: 1875, *Coal and Iron Record;* 1877, *The Mining Review* (Denver); 1879, *The Polytechnic Review;* 1902, *Mining and Metallurgy;* 1906, *Mining Magazine;* 1917, *Mining and Engineering World.* The successive editors have been Rossiter W. Raymond, Richard P. Rothwell, Fred Hobart, David T. Day, T. A. Rickard, W. R. Ingalls, J. E. Spurr, and A. W. Allen.

On April 1, 1922, *Engineering and Mining Journal* was consolidated with *Mining and Scientific Press* as *Engineering and Mining Journal-Press.*

The *Mining and Scientific Press* was established in 1860 as the *Scientific Press.* Three years later "Mining" was added to the title. The editors have been Almond D. Hodges, Charles G. Yale, J. F. Halloran, T. A. Rickard (twice), and H. Foster Bain.

On July 1, 1926, the consolidated magazine reverted to its former name, *Engineering and Mining Journal.*

The staff of the *Engineering and Mining Journal* consists of A. W. Allen, Editor; T. A. Rickard, Contributing Editor; E. H. Robie, George J. Young, A. H. Hubbell, and A. B. Parsons, Associate Editors; W. N. P. Reed, H. D. Keiser, and Homar L. Johnson, Assistant Editors.

## For and Against a Virile Metal Exchange

PLANS are maturing for the reorganization of the lately moribund New York Metal Exchange, with the hope of establishing a broad open market for trading in metals in the United States. It appears that several firms owning seats on the New York Stock Exchange, in addition to a dozen or more commodity brokers, have made application for membership. The co-operation of strong houses that do a large trading or commission business would be necessary to put the exchange in a dominant position in the market. First to receive attention will be tin, about 80,000 tons of which, imported into the United States in 1927, had a value of $100,000,000—representing a business of no small proportions. Moreover, there are speculative dealings in tin by traders and the general public which would create a considerable brokerage business.

According to the announced plans, attention will be directed later to copper, lead, and zinc. Although some success may be achieved in connection with tin, it is unlikely that much progress will be made so far as the other metals are concerned. The primary producers of these metals are strongly opposed to a metal exchange, and without their co-operation little could be accomplished. Among the principal arguments advanced in favor of a flourishing exchange dealing in metals for both prompt and future delivery are:

(1) That speculation by professional traders and the public makes for a generally healthy market. It tends to keep prices at levels that at all times reflect the position as influenced by supply and demand.

(2) That the producer is able to realize on his production promptly, thereby transferring to the public the burden of financing his operations, especially during periods of market stagnation.

(3) That a strong exchange would make it possible to ascertain accurately at any time the true state of the market, thereby obviating the sometimes tedious and uncertain process of private negotiation in buying or selling metal under present conditions.

(4) That hedging on the part of consumers would be facilitated. This, probably, is the most forceful of the arguments. Unquestionably, definite economic benefits to the consuming branch of industry would accrue from the creation of a broad open metal market.

*Per contra,* the big producers maintain that an open exchange would give speculators an opportunity to manipulate the market, thereby accentuating the peaks and dips in the price curve and, consequently, operating to the serious disadvantage of the consumer as well as to the producer of metals; that most of the producers are large companies having ample resources, and that unlike the average farmer, for instance, they require no assistance from the public in shouldering the financial burden; that, if the consumers will buy with fair regularity to meet their requirements for a reasonable period in advance, rapid and wide fluctuations will be avoided, the going price will be easily ascertainable, and the need for hedging will be minimized. These arguments are advanced largely out of courtesy, for the producers clearly hold the whip hand, and no reason need be given, except that they do not favor a metal exchange. One objection, not so often mentioned, is that if a small army of brokers, dealers, and traders obtain a living from buying and selling metals, the spread between the price paid by the consumer and that realized by the producer will be increased.

In any event, unless producers reverse their present firmly established attitude, not much may be expected by the revamped exchange so far as copper, zinc, and lead are concerned.

## To Effect Closer Co-operation Between Engineering and Business

EXTENSION of McGraw-Hill publishing activities to every branch of American business is the most significant effect of the merger of the A. W. Shaw Company, of Chicago, and the McGraw-Hill Publishing Company, Inc., announced recently.

Heretofore the magazine publishing activities of the

McGraw-Hill organization have been confined to specialized service in the major engineering industries and the trade channels for distributing the products. The book division of the organization, it is true, has long since broadened its scope: it publishes books not only on engineering, management, and industrial subjects, but on general business and scientific agriculture.

As a result of the merger announced, the McGraw-Hill institution now acquires a medium by which it can speak to the whole range of American business. *The Magazine of Business,* founded by the A. W. Shaw Company, has a circulation of more than 150,000; it deals with the problems fundamental to all business—finance, production, distribution and sales, management, transportation and export trade. It treats, as well, of those major movements in legislation that bear on business, such as taxation, tariff, and government regulation.

The importance of this new extension of McGraw-Hill activities is apparent to all who have followed the standards which, under the leadership of Mr. James H. McGraw, have dominated its publications. To give, through effective organization, the best of which they are capable is his constant admonition to the publishers and editors working under his direction. It presages a virile development of an already effective service to the whole business structure.

Further, it is significant that in referring to *The Magazine of Business,* Mr. McGraw, in his announcement of the merger, closed with these words, "It will fight for the interests of business, but it will place in an equally important position the responsibility of business to the public. It will, in a word, stand for true business statesmanship."

## Ford Company Discontinues Lead Smelting Operations

JUST why Mr. Henry Ford has discontinued the purchase and collection of used storage-battery plates, and the smelting of them to produce raw material for the manufacture of new batteries, is a topic of lively current discussion in some quarters. About four years ago, he commenced purchasing plates directly from the owners of garages and battery-service stations in important cities over a wide territory in the north central states. He accumulated carload lots and shipped them to one of two smelting plants—at Highland Park, Detroit, and on Fire Island, near New York. These, having a combined capacity of about 90 tons per day, were operated for several years.

He is as reticent as to reasons for discontinuing this practice a few months ago as he was about launching the undertaking in the first instance. But any one is at liberty to speculate—and speculation as to the motives behind a move on the part of Mr. Ford and his organization is usually interesting. It seems doubtful that he ever expected to be able to collect battery plates as cheaply as can the "junk" or scrap dealer who is regularly in the business of buying all kinds of waste products, from glass flasks to old machinery. Nor could he reasonably have expected to operate comparatively small furnaces to produce lead as economically as regular smelters of lead ore, of scrap metals, or of both. Presumably some realloying would be necessary to obtain the desired mixture for making new plates; and dross would be produced as a byproduct that would have to be shipped and sold to some other smelter. Each of these factors would tend to increase the final cost of Ford's own lead. He probably foresaw the difficulties, and realized that he could not compete successfully with lead purchased in the open market.

One suspects that Mr. Ford went into the project primarily in pursuance of his policy of independence, so far as possible, in respect to all necessary raw materials. Possibly he thought that money could be saved also. If so, the mistake has evidently been realized. One thing has been accomplished, however: he has learned where, and how battery lead can be obtained independently of any smelter, any scrap metal dealer, or, for that matter, of any mine. He has probably paid something for the experience gained; but his venture into the lead business is not the first that has netted little but experience.

## Influence of Increased Productivity on National Employment

AN ANALYSIS of conflicting opinion is always of interest, especially when the divergence is international. In the United States, among all classes, it is generally agreed that greater productivity is helpful in broadening national progress—a stimulant to wider employment and greater contentment, though adjustment to changing economic conditions may be frequent. The labor party in Great Britain, on the other hand, despite the claims of its leaders that it favors the advancement of science, is apparently still timorous of the effect of industrial expansion. Mr. A. G. Glasgow, chairman of the London engineering firm of Messrs. Humphreys & Glasgow, speaking at the commencement exercises at the Stevens Institute of Technology recently, is reported as stating that the keynote of British trade unionism is the antiquated and discredited fallacy that increased production spells unemployment; that the man who produces in quantity eventually works himself and his mate out of a job; that men should be paid to loaf occasionally rather than to work continuously and efficiently.

As a result of this mistaken policy, according to Mr. Glasgow, Great Britain, unable to feed one-fourth of her population and obliged to export enough products to pay for most of the food needed, now finds her traditional marts abroad invaded by competitors. Not only is her essential foreign trade imperiled, but she is being driven to take steps to protect home markets from the products of foreign nations whose workmen look with favor on the machine as a means of escape from physical drudgery and as a factor in the assurance of greater prosperity to all.

Success, however, is not the inevitable result of the adoption of the machine. Whereas there is little opportunity for the manual laborer to advance in technique and efficiency, the field for improvement in the machine is almost unlimited. Equipment, therefore, must be frequently replaced. Obsolescence is evident generally long before the limit of useful life has been reached. The advantages in utilizing mechanical power and modern equipment are therefore cumulative in direct proportion to the alertness of the directing officials and the spirit of co-operation evidenced by the workmen. The importance of utilizing modern mechanical equipment cannot be overestimated, but a definite policy must be adopted, based on a study of operating conditions and probable economic trends. It is necessary to check frequently the

efficiency of equipment; an inefficient machine may be more costly than an efficient laborer. An example of one large mine may be cited, where the use of air gages on the lines to the rock drills disclosed the fact that many machines in operation were consuming abnormal volumes of air. The check indicated the need for a more systematic program of operating control. Repairs were made more promptly, and large savings resulted.

The output, performance, and power consumption of a machine, not its age or condition, must determine whether or no it should be scrapped. Progress in the manufacturing industries is rapid; competition is keen; invention is cumulative. Maximum profits are possible only by the utilization of the most up-to-date aids to increased output and decreased costs. A sane workman will welcome any innovation that aims to secure better results; he will favor a policy of equipment replacement based on mechanical obsolescence rather than old age. But he expects a share in the increased profits. In the United States he is getting a share, and may expect to get a greater share as his standard of living is raised and dormant ambitions are encouraged.

## All Promises Well Unless the Socialists Win

OF COURSE, no one takes political platforms seriously. That of the party in power emphasizes the good things of the last four years and promises an almost perfect state if the party's candidate is again elected; that of the opposition deplores the causes of such dissatisfaction as has existed, the remedy for which lies in a change in the administration. True to form, both the Kansas City and Houston platforms are designed to get as many votes as possible, and to outrage no one's feelings. And yet there is a natural curiosity to see what mention is made of one's favorite interests.

Of mining, the Republicans and Democrats speak like twin brothers nurtured on the same bottle. Each platform says that, as an industry, it is second only to agriculture, and that the United States produces more coal, iron, and copper than any other country in the world. The Republicans add silver to the list, indicating that what goes on in Mexico is beneath notice. Then the Republicans continue, saying that "the Government should make every effort to aid the industry by protection, by removing any restrictions which may be hampering its development, and by increased technical and economic research investigations." And the Democrats put it this way: "Mining has suffered like agriculture, and from similar causes. It is the duty of our Government to foster this industry and to remove the restrictions that destroy its prosperity."

It is unfortunate that all mining is classed together. Coal mining is in quite a different position from the industries engaged in the mining of metals and other non-metallic minerals, and to intimate that all mining is in a bad way is untrue. Both parties mention "restrictions" hampering the mining industry. Just what restrictions are meant? The only real specific and effective restriction of any moment that comes to mind is the restriction to hydraulic mining in California.

The metal mining industry thanks each party for its promises of care and protection, and looks forward to another four years at least as prosperous as the last four.

## Long-Distance Transportation of Molten Metal

ONE of the most interesting large-scale innovations in the metal industry was reported from the Miami Valley recently. A service was put into operation involving the transport, over ten miles of special track, of molten iron from the blast furnaces of the Hamilton Iron & Coke Company, of Hamilton, Ohio, to the east works of the American Rolling Mill Company at Middletown.

Ores used come from the Mesabi Range in Minnesota and the Cuyuna Range in northern Michigan. Smelting at Hamilton follows customary practice, after which the molten iron is poured, via a large ladle car, into a special transporting ladle, with a capacity of 150 tons, doubly insulated with firebrick. At Middletown the metal is delivered direct to the open-hearth furnaces.

The trip from Hamilton to Middletown takes 2½ hours. The special ladle cars used are each equipped with 16 axles, carrying a total load—car and molten metal—of 340 tons. The special track and supports, constructed by the B. & O. R.R., cost $1,500,000. Needless to say, the track is not built for carrying passenger or high-speed trains.

Short transportation of molten metal is nothing new, of course; but the size of this development indicates significant progress in attacking large problems, to the end that costs may be reduced, through savings in time, labor and fuel. The non-ferrous metal industries are not usually concerned with the disposition of large tonnages of molten metal; but if and when occasion arises, the recent achievement in the Miami Valley may serve to provide data and inspiration.

## Reducing the Hazards of Mining

NOWHERE is the old adage that "experience teaches" more applicable than to underground mining operations. The proportion of accidents caused by ignorance on the part of workers employed at hazardous tasks is undoubtedly large. The higher rate of underground remuneration is attractive to the employee, and it is common practice in some regions for ordinary laborers to step directly into mining work at the first opportunity. An appreciable proportion of underground accidents doubtless results from the practice of sending relatively inexperienced men into the stopes and drift faces. The mine foreman or shift boss is not the only one to be censured for such practice, as applicants for underground work frequently misrepresent their qualifications and experience.

The various states might well consider the adoption of regulations that would require specific examination of individuals for mine employment. The practical application of such regulations would be difficult, it is true, though a general realization of the importance of the problem would do much to hasten the enactment of such legislation and lessen difficulties of application. Many large companies have shown a willingness to co-operate with government agencies in safeguarding the welfare of employees and lessening the possibility of accident to life and limb, at any reasonable cost. Some companies have strict regulations with which applicants for underground employment in their mines must comply; and similar precautions elsewhere would do much to lessen hazard.

# *Mining Men of Note*

## LUDWIG VOGELSTEIN

LUDWIG VOGELSTEIN

THE development of the ore-buying industry came from Europe; and, with exceptionally attractive opportunities to those who had acquired the training abroad, the United States in the nineties was a fertile field. Germany for many years supplied the major governing prices of the metals, as well as statistics; and Frankfort still continues as the central city in this respect. Since then, New York has become an important metal mart, and it is therefore natural that among the outstanding operators should be found men who had gained their early experience in Germany in contact with German interests. Bohemia, now renamed Czechoslovakia, has been a mining country, though not pre-eminently so, for several centuries; and closely allied with Germany in various respects other than by language ties. Many Bohemians have been educated in Germany, and so have become interested in German industries. An example is found in Mr. Ludwig Vogelstein, well known in the metal world, more especially in regard to "what goes on in copper." His long residence in New York and his interest in mining and metallurgical operations, essential to the production of metals, have made him an authority on the subject.

Mr. Vogelstein, son of Dr. Heinemann and Rosa Vogelstein, was born at Pilsen, Bohemia, on Feb. 3, 1871. His education was finished at Stettin, Germany, where he graduated from the Gymnasium in 1889. He first became associated with the firm of Aron Hirsch & Sohn, of Halberstadt, well known as important traders in copper, zinc, and lead, remaining there until October, 1896; thus he acquired an excellent grounding for his chosen field. That his training and experience were sound is reflected in his present standing in the metal industry—as excellent abroad as in the United States—and such must have been the opinion of the heads of the firm.

Mr. Vogelstein arrived in New York in November, 1896, opening up an office under his own name early in 1897 as the American representative of Aron Hirsch & Sohn. Since then he has become a factor in the metal operations in the United States, particularly in regard to copper, zinc, lead, gold, and silver. He has also operated in the production and selling of antimonial lead, selenium, arsenic, zinc sulphate, sulphuric acid, platinum, palladium, and iridium. In 1901 the firm was incorporated as L. Vogelstein & Company, continuing as such until Dec. 31, 1916, to be reincorporated as L. Vogelstein & Company, Inc., which in turn was amalgamated on Jan. 1, 1920, with The American Metal Company, Ltd. As might be expected, this energetic firm has expanded into activities akin to its earlier operations. In consequence Mr. Vogelstein has become associated with several mining and smelting enterprises, including the U. S. Metals Refining Company, of which he is president and director; the American Zinc & Chemical Company, of which he is a director; the Chanute Spelter Company, of which he is vice-president and director; The American Metal Company, Ltd., of which he is chairman of the board and director, which is affiliated with the Compañia Minera de Peñoles, of Mexico, and the Minas de Metahambre of Cuba; and the Climax Molybdenum Company, of which he is vice-president and director. He is a vice-president of Copper Exporters, Inc., and a member of the executive committee of the Copper Institute.

Mr. Vogelstein is an influence of importance in the metal industry of the United States; his knowledge of the copper market has made him an authority on world operations in that metal.

*The platea, looking north. Left to right are the clinic, foundry, machine shop, locomotive house, blacksmith shop, storehouse, carpenter shop and oil storage. In the center is the laboratory, and on the right, the now abandoned ore-loading chutes*

# *The Cyprus Mines Enterprise—I*

## A Historic Property Operated Under American Control

By V. G. HILLS

*Cyprus Mines Corporation, Skouriotissa, Nicosia, Cyprus*

THE only known ancient record of the operation of the Skouriotissa mine, in Cyprus, is by Galen, a noted medical author and physician to the emperor Marcus Aurelius. He visited these mines in 166 A. D. This account came to light through Dr. Joseph Walsh, of Philadelphia, Pa., who is engaged in writing a life of Galen. As a result of correspondence with the late Seeley W. Mudd, he furnished Colonel Mudd with an original translation from the Greek of Galen's account of his Cyprus visit. A work entitled "Excerpta Cypria," by Claud D. Cobham (University Press, Cambridge, 1908), purports to be a compilation of the accounts of travelers who have written of Cyprus. The author quotes from twelve languages by eighty writers, but Galen's name is not among them. His reference to the mines of Cyprus has been entirely overlooked. A portion of the Galen narrative recently appeared in an article contributed by Dr. Walsh and printed in the *Bulletin* of the Geographical Society of Philadelphia. I quote extracts that will appeal to mining and engineering readers.

The object of Galen's visit was to procure the mineral waters for medical purposes. He says:

"I had an influential friend in Cyprus who was acquainted with the representative of the emperor, the superintendent of the mines, and I carried away a large quantity of cadmia, diphryges, copper ore, copperas, misy, sory and chalcanthos."

This supervisor accompanied him on his rounds to the different mines, and further on he says:

"In connection with the Cyprian mine, of which I have already spoken, in the mountains of Soli, there was a large house, the descent into the mine was on the right of it, to us entering on the left. Deep on the interior the guide pointed out three layers, one above the other, the lowest of sory, the next of chalcitis, the highest of misy, saying: 'You come at a time when there is a poverty of furnace cadmia, but you have before you a wonderful wealth of these three.' Accepting a large amount of misy, I brought it with me to Pergamum, and later to Rome, and have it yet [196 A.D.], though more or less than thirty years have elapsed."

In another place he describes the collection of copperas water and the making of chalcanthos:

"There was a large low house sheltering the ingress into the mine. It was dug into the hill like a cave, in width so that three men touched, in height so that the tallest could walk upright, and on a slight incline. At the bottom, about a stadium from the entrance, there was a lake or tepid, thick, green, greasy water. Throughout the descent the temperature was about the same as that in the first room of the bath, ordinarily called the promalacterion.

"The water dripping from the porous hill drop by drop is collected throughout the twenty-four hours in Roman amphoræ. Slaves carried it out and poured it into square earthenware troughs located at the entrance of the house, where after a few days it thickened and chalcanthros was made. At the bottom of the mine the brassy odor is suffocating, and is tolerated with difficulty. The water has a similar taste. The slaves, nude, carried the jars with the greatest haste in order not to remain long in the mine. There were lights at moderate intervals, but they extinguished frequently. The mine was excavated little by little by the slaves over many years. When the dripping water begins to lessen, the slaves dig further into the hill.

"It sometimes happens a cave-in occurs, killing all to the last man, and blocking up the passage."

He describes a third mine, where he procured "diphryges" [a byproduct of zinc oxide] thus:

"About 30 stadia [about three miles] distant from Soli, situated in the middle of a village with houses all about it. The prefect and procurator of the mine said it was the useless byproduct (diphryges) after obtaining cadmia, and

as such was thrown away like common ashes. To me it was an extremely valuable drug in purifying ulcers of the mouth and sore throat, either alone or mixed with honey."

Elsewhere is an interesting though rather mysterious narrative:

"Prompholyx originates in the copper ore oven like cadmia, and similarly when cadmia itself is smelted. Since the superintendent of the mine did not have ready an ore oven, he ordered that prompholyx be prepared from cadmia,

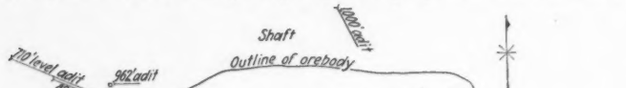



*Fig. 1—Outline of orebody and main mine outlets*

while we looked on. After explaining that it has a nature like copper ore, he threw a number of fragments of cadmia on the fire. The smelting chamber was curved, was without an opening, and took the entire ash given off; gathered together this contained the prompholyx. What fell to the floor was spodium [impure zinc oxide?] which is particularly large in amount in the smelting of copper ore."

Twenty years later he wrote again about some of the ore he had procured from these mines:

"By chance this work [on drugs] was completed to the eighth book twenty years ago [176 A.D.] and the ninth not added, because I had not yet seen certain stones, which I wished to describe. Later, apparently about 186 A.D., when I was about ready to add this ninth book, the following experience occurred: In the preparation of a remedy I had need of misy, and took a handful of clumped misy. This clump, however, had a consistency which misy is not accustomed to have, since it usually separates into small pieces. Wondering over this peculiarity, I examined it carefully, and found on the outside a kind of misy which surrounded the inner part, like an efflorescence [incrustation] while underneath was a certain transitional form between chalcitis and misy; in order words, the middle was changing from chalcitis to misy. Originally, the clump was chalcitis and the inner part remained true and was not yet changed. On this I remembered that in the mine misy stood over chalcitis just as verdigris over copper, and I determined to watch what remained in my possession of the sory to see if it did not show a gradual conversion into chalcitis, and this proved true. As a result it is not to be wondered at that these three drugs are of similar therapeutic effect, and are different only by their fineness or roughness—sory being the roughest, misy the finest, and chalcitis standing in the middle. All three are caustic and astringent."

The exact nature of chalcitis and misy has not been determined, but they appear to be impure combinations of iron. The account abounds in descriptions of furnace reactions and products, and seems to indicate that zinc was produced or used with the copper. What they were doing with those furnaces is a mystery. There is no zinc ore here. It seems possible that the terms translated into words now indicating zinc refer to something different, probably iron sulphates.

The ruins of the Roman city of Soli are in plentiful evidence, one mile west of our ore-loading jetty. Great blocks of stone used in the breakwater show near the surface of the sea. The site of the ancient harbor is filled by the detritus of the river that discharges there and is occupied by grain fields and fig orchards. I note that the description "about 30 stadia distant from Soli, situated in the middle of a village with houses all about it" points unmistakably to our Mavrovouni mine.

The place where the mine water was carried out to evaporate and make chalcanthos is identified as the present producing mine of the Cyprus Mines Corporation at Skouriotissa. Mining in Cyprus probably ceased with the decadence of the Roman Empire, and these mines were almost forgotten until the recent rediscovery.

## Ancient Mine Workings

Our underground mine workings occasionally disclose ancient passageways, but no vertical shafts. All descents were by inclined planes, either direct or spiral, with slopes usually about 20 deg.; but a few, in places, reach 30 deg. and have stairs. No system or regularity is in evidence except in one unique instance, to be noted later. The passageways vary in height from 3 to 6 ft., in width from 2 to 4 ft., and in grade from level to inclined stairways. Where stairs are cut, the average rise is 5½ in. and the tread 10 in.

These ancient passages usually end in tight cave fills, and always so when followed upward toward the surface. The direction in which they point shows roughly the

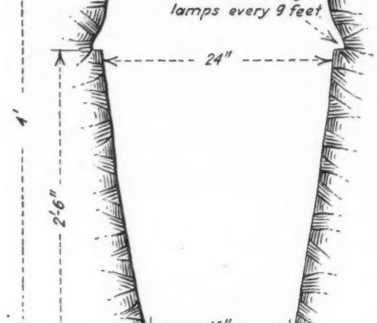



*Fig. 2—Cross-section of ancient adit or drift*

place of original entrance, with no sign of outlet at the surface. There, the portals caved, and the wash of the centuries has made the mountainside look natural.

The plan, Fig. 1, indicating the present main workings of the mine also shows the position of some of these ancient workings. The location of two ancient portals is known, and the position of the remains of the stone foundations marking the presumed Galen entrance; but nothing has been disclosed underground that can be identified as this particular incline, though it was certainly the main entrance of that period. Where mining was carried on for centuries, doubtless by different peoples and intermittently, it is readily realized that different openings were made as the earlier ones caved or the place of operations shifted.

The cross-section of a typical adit or drift is shown by Fig. 2, which bears out the general historical accounts of ancient mining, in that the rock was all carried out on the backs of slaves. Frequent niches show that the working passages were lighted by stationary lamps. Galen's account mentions these. The little clay olive-oil lamps

would be unhandy to carry, and the slaves needed both hands for their burdens. In places the niches are only 2 to 3 ft. apart, made thus, no doubt, as work progressed in the heading.

Recently, mining operations have broken into another series of ancient workings. Fig. 3 gives the plan and sections. These workings are in barren country rock. It is ground a modern miner would break with powder, but which could be, and was, worked with pick only. At the entrance the incline is of the ordinary ancient type, and barely 3 ft. wide. The upper end presents a cave fill, which, from the profile, doubtless continues to the surface. The surface of the mountain shows no indication of the ancient portal. Mr. Gunther's adit, just above, was driven in 1913. The discovery was made by a drift on the 858 level breaking into the bottom of this incline, as shown in Fig. 3. The lower ends of both branches present cave fills. In places the drifts are as clean as though made only a month ago, but in other workings there is more or less débris from caving. In these drifts were found some fine selenite in crystals $\frac{1}{16}$ in. diameter and $1\frac{1}{2}$ in. long and in stalactites up to 5 in. long, formed since the workings were made.

The lower drift is a puzzle. The most plausible explanation seems to be that it was driven south and west from the point marked *C*, Fig. 3, which is not far from ancient filled workings in ore, with the purpose of making connection with the incline outlet. Only a slight change in either course or grade would have struck the incline in about 60 ft. The Romans were sufficiently capable at surveying to know where they were going. The overseer in charge here must have been a prototype of some we occasionally find yet who think they do not need a surveyor. When within 16 ft. of the point where connection was finally made, he drove a loup 300 ft. and twice passed over his own work with less than 3 ft. between his feet and the back of his own drift below. The strangest thing in connection with this drift is its unusual size and the regular cross-section and grade. Here the grade is fairly regular ($2\frac{1}{2}$ per cent), rising from the point *C* for the entire 360 ft. The drift is full 4 ft. wide at the floor, with the sides rising perpendicular for 5 ft., and it is mostly 6 ft. high in the center. No such cross-section has been found in any other ancient working, either at this mine or elsewhere on the island. And the mystery is increased by its apparent purpose of simply making a connection with an ordinary outlet 3 ft. wide.

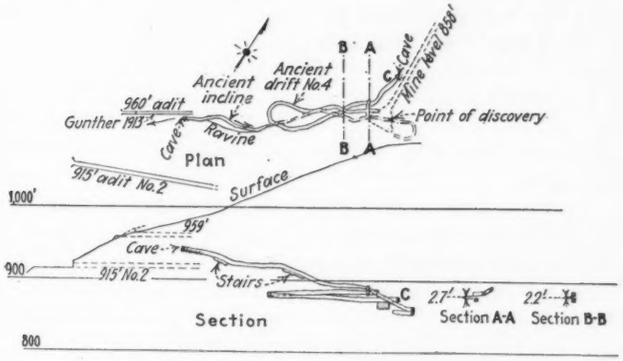



*Fig. 3—Plan and section of ancient workings discovered last year*

Thus far, no tools whatever have been found in the ancient working here. I have read with much interest Mr. Rickard's account in *Engineering and Mining Journal* of July 2, 1927, of the Roman tools found at Rio Tinto. Here it is considered that the acid water would have consumed any iron tool in much less time than has elapsed since the Roman period. That some tools of bronze may yet be found is a natural hope. Wood handles should have been preserved, but none has been found. Small pieces of wood that have been found usually have malachite deposited in the pores. The ancient timber is generally charred and friable; or a little pocket of charcoal is found which probably represents the end of a post. Recently a Roman pick was discovered.

In 1912, C. G. Gunther, supported by Seeley W. Mudd and Philip Wiseman, set out to prospect for ancient mines in the Near East countries. The expedition was organized on a scientific basis, and was successfully consummated, but, none the less, it was a prospecting venture solely. Among other regions, Mr. Gunther visited Cyprus, and there found an area which he believed should be prospected. A churn drill was brought from the United States in March, 1914. The first eight holes were put down with no result. The ninth struck the ore. Drilling was continued until October, 1914, and was resumed in 1919.

The Cyprus Mines Corporation was organized in 1916 by Mr. Mudd and Mr. Wiseman. It is incorporated under the laws of the State of New York, with the main office at 1206 Pacific Mutual Building, Los Angeles, Calif. Wilkens & Devereux, consulting engineers, represent the company in London. The company has agents at Port Said and Famagusta. It holds two separate 50-year leases: one on the Skouriotissa mine, now producing, the other on the Mavrovouni mine, which is in process of development, and a 50-year lease on the Skouriotissa Monastery property, consisting of lands, buildings, and water rights; and further holdings of agricultural lands have been acquired by purchase.

The first ore shipped from the mine was taken to Pendayia by the company railway in 1922. During this year, when there were no lighters for transferring from the jetty to ships, some ore for samples—several hundred tons—was started from the mine for the port of Famagusta. The first lot was sent out in five-ton mine cars over the government railway. Some of these cars failed on the way, and the ore was transferred to government cars. After this, government railway cars came on the company's track and loaded at the mine chutes, taking additional ore to complete the sample lot at Famagusta.

The first shipment, 4,634 tons, was loaded from the Pendayia jetty by five native sailing lighters, which carried about fifteen tons each. This was a red-letter day for the natives, and more than 1,000 of them assembled to watch proceedings. Within the life of the oldest inhabitant, no boat so large as that 6,000-ton freighter had been seen in Morphou Bay.

The company's No. 1 locomotive worked day and night steadily for two or three years, and when it had to be taken off for repairs, the empty cars were hauled from shore to mine by mules. During this period only about 250 tons per day could be taken to the shore.

It had been the intention to use the locomotive to handle the five-ton cars on the jetty, but it proved too heavy and cumbersome, and the cars were pushed by hand until the first Fordson locomotive was constructed. This was made by mounting a Ford tractor on the trucks of a five-ton mine car. After this was once seen in operation, it was impossible to get enough natives to push a car.

***(To Be Continued)***

# *When the Small Mine Pays*

## The Conditions That Mean Success or Failure

By GEORGE J. YOUNG
*Associate Editor*

ONLY the exceptional small mining property develops into the large mine, although the small mine may be sometimes highly successful. Large mines are often recognized as such at the start, the abundance of mineralization being evident. Whether it can be considered commercial or otherwise depends upon the tonnage, grade, ease of ore treatment, and probable marketing conditions. The facts are determined through exploration by drill or underground workings, sampling and intensive study of the conditions by competent engineers. A compact orebody or several orebodies in close proximity involving large tonnages of low-grade ore offer opportunities for exploitation. Its success will depend fully as much upon good management as upon the grade of ore, workability of ore and marketing arrangements. The problem has been worked out in a number of instances. The small mine of limited tonnage and of low-grade ore is out of the running except where waste rock can be eliminated and the tonnage and ore grade are sufficient to afford a good surplus over expenditures. If the ore in this small mine is high grade and can be mined selectively, the property may be made to pay. A chance must be taken upon the initial exploratory work, for the contents of a vein can be determined in no other way. The first work is done upon the outcrop and has for its purpose the discovery of mineralization and its nature. Upon its results and upon the miner's judgment depends the question of deeper work. Not all quartz veins are sufficiently mineralized, some not at all, to offer promise of orebodies. Consistent values, obtained by sampling transverse cuts in the outcrop, are encouraging.

IF A PROMISING vein or narrow mineralized zone has been discovered the owner has four possibilities, namely, to sell; to do additional exploration work by hand tools at low cost; to equip with compressor, tool-sharpening outfit, and, if necessary, a hoist, and to explore rapidly upon several levels; or to diamond drill. The availability of portable compressor equipment, gasoline and air hoists, and efficient drills has generally made hand methods obsolete. Mechanical equipment involves a capital of from $5,000 to $12,000. To sink a 100-ft. shaft and drift 300 ft. will cost about $5,000; to open two additional levels will cost another $10,000. Thus, to explore to a depth of 300 ft. and over a lateral extent of 300 ft., a projected vein area of 90,000 sq.ft., would involve expenditure of about $25,000. The total footage would be 1,200 ft. The time required would be about nine or ten months and about six experienced men would be necessary.

A portable diamond-drilling rig, capable of drilling to 1,000 ft. and operated by a portable compressor, will involve an outlay of about $6,000. Approximately 5,000 ft. of drilling, I am informed, could be done for about $14,000. This would require four men for two-shift operation. From 600 to 900 ft. of work could be done per month. From six to eight months would be necessary to complete the footage.

IT IS difficult to compare the two methods upon a footage basis, because the placing of holes and the topography would determine the effective footage in vein material in the case of the diamond drill. However, the fact remains that diamond drilling offers opportunity for exploring a vein in a relatively rapid and convenient way providing coring results are satisfactory. The effectiveness of the method would be open to question in the case of narrow veins and it would appear that the shaft and drift method might give more information, but restricted with reference to the strike of the vein.

In one method of exploration $25,000 is the capital involved; in the other $20,000. The nub of the situation is the financing. If ore is not found, only the capital represented by the equipment remains; if only a limited quantity of ore is indicated, the result may be the same, although there is some chance of retrieving a part or all of the exploration cost. If a considerable tonnage of commercial ore is indicated, the result is a happy one. In some cases, indecisive results are obtained and more capital is expended for additional exploration work. Some prospects are called "teasers," for their victims are lured into greater and greater expenditures, with the "mine" ever in the dim future. There are also "near mines" or mines that lack one of the vital characteristics determining profitable operation. An engineer who can point out such lack in an early stage and support his opinion in the face of determination on the part of interested owners to deceive themselves is a courageous individual.

A prospector with $25,000 in hand would probably not be considered a prospector. A mining man who had the necessary capital or who could get it is one of the hopes of the prospector or claim owner; an alternative is the promoter who offers to form a company and to obtain the necessary capital from shareholders; still another is the business man or a group of business men who can be persuaded to take a "flyer." Whether it be a rich mining man, a company, a business man or otherwise, an "angel" of some kind is necessary. Established mining companies will sometimes take over the property under option and conduct their own exploration work. In the few cases where "high-grade" sticks out at the surface, the lure is so strong that the claim owner does not often experience difficulty in finding both mining companies and individuals ready enough to take the chances of further exploration. Where the claim owner is without sufficient financial resources, the raising of capital involves

participation in ownership, either through a partnership or a company. Organization of a company is preferable to a partnership. In either case or in the event of a sale, an option or agreement fixes the status and terms of the ownership, temporary or otherwise. It is evident that price considerations can only be guessed.

Assuming that finances have been secured and the money spent under competent supervision and that ore has been discovered, the property passes to its next stage, which is either development or production, the former being necessary where exploration has been conducted by diamond drill. Production of two kinds can be distinguished, that of high-grade shipping ore resulting from selective mining, and that of concentrating or milling ore resulting from bulk stoping. The former requires the least capital outlay; the latter calls for concentrating and milling equipment. A 25-, 50- or 100-ton mill, with its power equipment, may be installed and operated. This involves increased capital and increased operating cost.

To insure success it is necessary first to have sufficient ore developed so that the property may be operated continuously.

The small operation needs skilled supervision and technical knowledge for its success as well as a sufficiency of ore. The limited tonnage handled prevents low unit-costs and, in consequence, economy and efficiency are vital. The ordinary handicaps are large.

Small projects fail often for a variety of reasons, such as building a mill before developing a sufficient tonnage of ore; inadequate capital; poor technical direction; wasting of funds through mistakes in design, management, and inexperienced operation or through too elaborate a company organization. Too much money may have been paid for the property or unwise option payments may have been arranged. Titles may be found defective. Expectations, based upon faulty sampling, may fail of realization. Stockholders may become discouraged and fail to pay assessments at critical times. Unexpected faults may cut off orebodies. Encountering excessive water at depth may exhaust the operating margin. In treating the ore metallurgical difficulties may arise.

ON THE other hand, two important considerations favor the small property—one is the availability of mechanical equipment and the other the availability of technically trained men, operators, and workers. The problem is one of suitable selection, both of equipment and of men. Financing is admittedly difficult under present conditions.

As examples of what management or location may mean to the small mine, the following cases may be cited:

Property *A* is favorably situated near a railroad, and is mining a comparatively low-grade ore by glory-hole and underground methods at the rate of 50 tons per day. Due to certain fluxing qualities of the ore it is favored with a market and yields a return from its metal content, which is copper, gold, silver and iron. The margin is small, but with economical management a fair profit is made. Twelve men including a foreman are employed at an average wage of about $5 per day. Overhead expense probably does not exceed 5c. per ton. The property could not be operated were it not for its proximity to a railroad.

Property *B* has been operated for more than ten years; it has outstanding 178,000 shares, with par value of $1, out of $200,000 capitalization. Equipment was originally a 10-stamp mill; a ball mill was added later and additional property with other mills has been acquired. Several millions have been paid in dividends. The vein is relatively small but persistent and is now almost barren, but numerous small, high-grade shoots have been found. By careful working little has been missed. A mining engineer calls it a big gold mine and, if the gold output be considered, it might be so termed, but in a physical sense it is a small property. Conservative, careful management has made it a success. The vein is explored by tunnels and a winze. The mechanical equipment is good.

PROPERTY *C* was incorporated in 1911 with a capitalization of $200,000, of which 170,000 shares, par value $1, have been issued. The 2-ft. quartz vein on the property is developed by a 1,000-ft. incline and about 15,000 ft. of workings. Output is about 1,000 tons per month. Production since 1919 has been more than $1,000,000 in gold. For a seven-year period the ore value has averaged more than $13 per ton. About 40 men are employed. A persistent oreshoot and economical management have made this property.

The three properties above described are in California. Other properties in the Western states might be mentioned. The Betty O'Neal and the Gold Circle, in Nevada, are instances. Of the smaller copper properties, the Walker and the Engels have been successful. However, a search of records indicates a large proportion of dormant, and idle mining properties at which equipment has been installed and some work has been done, but which have not achieved productive operation. Some have passed the period of operation. Others are idle for want of funds. Probably many of these mines are hopeless, but with competent direction and adequate financing some offer opportunity of successful operation. There is an attractive field here for the unattached mining engineer with an opportunity for co-operation between mining geologist and engineer, the one contributing his knowledge of structure and ore deposits, the other his operating experience.

It will be of interest to examine a few cases of failure to achieve profitable operation of a mine. For example, in the case of mine *D* (gold), the company was organized in 1921 with an authorized capital stock of 5,000,000 shares, par value 20c. each; 750,000 sold for 10c. each and 375,000 for 25c. each ($168,750); 1,175,000 shares were escrowed as part payment for the property; the purchase price of property over and above escrowed stock was $200,000, with payments extending over five years, the company obligating itself to pay a royalty of 25 per cent of the gross returns on all ores milled, payments applying on the purchase price. Other property was purchased involving obligations of $31,600. Operations began in 1921, and, after unwatering the shaft, an orebody 150 ft. in length, of an average width of 10 ft., was exposed on the 440-ft. level. In the interval to the end of 1926, some 63,783 tons of ore was milled; gross production was $415,741; operating expenses, excluding development and depreciation, $359,377; development, pro rata, $82,124; loss without depreciation, $25,759.23. Plant and equipment totaled $157,968; mining development, $237,905. The shaft had been sunk to the 1,800 level and by March, 1927, had reached a depth of 2,080 ft. Assessments to the amount of $229,047 were collected. In 1926 unpaid obligations upon various parcels of land amounted to $306,014. Additional mining prop-

erty had been purchased and stock given for the original mine property. To illustrate the uncertainties of mining, the 800 level failed to intersect the oreshoot which had been worked on the upper levels. A fault cut off the orebody at this level and it was found 50 ft. above. Failure to find the downward extension beyond the fault disrupted the milling campaign. Exploratory operations were next undertaken. Several geological reports were obtained, but although some ore was found, an oreshoot of sufficient size to provide steady mill operation was not discovered despite persistent efforts and comparatively large expenditures. Deep exploration for ore is being continued by the company.

In the case of mine *E*, the company was incorporated in 1919 and subsequent corporation changes ensued. The property was a lead-zinc prospect; exploration showed considerable quantities of ore, on which was based the capitalization of $3,000,000, par $1; 2,206,058 shares outstanding. Also, on the strength of this ore showing, an outside company advanced capital to build a mill. Insufficient water supply and other troubles prevented continuous milling; some production was made but at high cost. Changes of management were made. The stock was shuttled up and down. Workings consisted of an 800-ft. shaft and 15,000 ft. or more of drifts and crosscuts. The company failed to find the downward extensions of orebodies, nor did it find new orebodies. Ten assessments were levied, totaling 22c. per share; a funded debt amounted to $197,900 and other obligations were incurred. According to a financial statement, "development" totaled $540,800 and equipment was listed at $277,900. At the last account the company was still searching for ore.

Mine *F* was an old lead-silver property. A 400-ft. shaft, a winze to an additional depth of 100 ft., and 3,200 ft. of workings developed a fair-sized orebody. A 75-ton concentrator was built in 1917. Ambitious plans were then set going and a flotation plant and lead smelter were constructed in 1919 and operated to a small extent. The company failed and the "remains" were reincorporated to protect the stockholders. Subsequently another company took over the property, sunk the shaft several hundred feet and sent out drifts and crosscuts with the result of developing sufficient ore to warrant the construction of a new mill.

NO ATTEMPT has been made to define the small mine. A mine that can produce 50 tons of ore a day, or about 15,000 tons per annum, with a probable life of five years or more, would be designated small. I am reminded of a small gold mine in Nevada which was explored by an 800-ft. shaft and six levels. An orebody, 600 ft. long, was exposed; tonnage was 60,000 and average value $14. A 30-stamp mill was installed and operated at 100 tons per day for five years. About $10 recovery was made; costs were $5 per ton and overhead was $3 per ton, leaving a net margin of $2 per ton. The operation paid. It is a good example of a small mine, recognized as such and operated under skilful management without frills or unnecessary expense.

The 20-acre farm cannot be operated on the same basis as the 1,000-acre tract, nor can the small mine be conducted on the same basis as the large mine. One engineer states emphatically that the small mine cannot afford a company organization. If this be the case, the partnership offers itself as an alternative, but this type of organization is open to objections. The individual operator is scarce. The large mining company ordinarily does not want a small property. Thus there is need for a simple type of company organization that will lessen the costs both for capital getting and for company operation. Need exists also for the engineer-specialist in small mine operation, one who can select both equipment and men and proportion outgo to suit the conditions. The small property needs systematic exploration and development in advance of ore mining and ore treatment. In this particular it does not differ from the larger properties. Unlike these, it requires a grade of ore substantially higher than that which would permit of large-scale operation. The smaller the tonnage handled per day, the higher the grade necessary to meet expenses. Continuity of operation is just as necessary as in the large property.

ADVANCES in metallurgy, especially in flotation and mill design, have been such that small and efficient milling plants which can be operated with a surprisingly small labor force can be provided. Recoveries are higher than in gravity concentration. The small Diesel engine and electrical equipment of excellent design have lessened the expense of power generation. Thus many of the real difficulties, other than financial, have the means available for their solution. No doubt a practical method of financing, fair to all parties concerned, will be worked out in time.

Interest in mining is kept up by the small mine. Experience has been developed in small operations which by their very nature require all-round ability and contact with both mining and metallurgic conditions. One experienced engineer states that skilled operators come, in general, from the small property. Credit is thus freely given to the small property for the part it has played and will continue to play in the initial development of operators, managers and workers. In the aggregate, small mines have contributed a substantial production and in addition have absorbed a considerable amount of mechanical equipment and supplies.

## Operating Costs at Lucky Tiger-Combination for 1927 and 1926 Compared

IN THE annual report of the Lucky Tiger-Combination Gold Mining Company for 1927 the following comparison of costs for the years 1927 and 1926 is presented:

**Unit Costs**

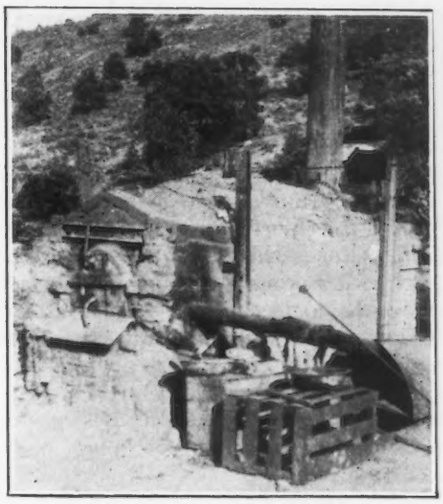
| | Per Ton of Ore | | Per Ounce of Silver in Concentrate | |
|---|---|---|---|---|
| | 1926 | 1927 | 1926 | 1927 |
| Development | $2.21 | $1.81 | $0.070 | $0.057 |
| Mining | 4.35 | 4.61 | 0.138 | 0.146 |
| Milling | 2.09 | 2.02 | 0.066 | 0.064 |
| Marketing | 7.58 | 6.87 | 0.241 | 0.217 |
| General | 0.96 | 0.85 | 0.030 | 0.027 |
| Income tax | 0.63 | 0.46 | 0.020 | 0.015 |
| Totals | $17.82 | $16.62 | $0.565 | $0.526 |
| Sundry profit | 0.03 | 0.25 | 0.001 | 0.008 |
| Credit for gold, copper, iron and lime | ..... | ..... | 0.219 | 0.128 |
| Net cost | $17.79 | $16.37 | $0.345 | $0.390 |

The slight increase in mining cost was caused by the reduced width of vein on the lower levels. Reduction in marketing cost was caused by a decrease in gold output. The increase in the net cost per ounce of silver is to be attributed to the same cause.

G. B. Mills, operator of the one-man mine and reduction plant

# *Prospector and Burro Operate Mine and Refinery*

By HOMAR L. JOHNSON
*Assistant Editor*



Front and side view of the "D" retort at the Container mine

## One-Man Venture Produces Five Flasks of Quicksilver per Month

LEGENDS of one-man mines are favored topics of conversation among prospectors and miners of the Western mining regions. Usually, the legend is a fabrication emanating from the vivid imagination and visionary mind of some "son of the desert," whose lonely existence has served to confuse anticipation with realization. Occasionally, however, attention is attracted to an undertaking which actually has enjoyed success under a one-man régime. Under the most auspicious circumstances, however, the owner of such a property is rarely able to produce a finished product—his ore or concentrate must be sold to a smelter or reduction plant for final treatment. Therefore, it is of particular interest to learn of the record of a Western prospector in successfully working a producing mine, alone; and not only performing the actual mining operation alone, but running a successful reduction plant at the same time; being thereby permitted to make a product directly salable to the consumer or consumer's agents. The prospector is G. B. Mills; his property, a quicksilver mine in the White Mountains, above Fish Lake Valley, about 60 miles west of Tonopah, Nev.

"Grubstaked" by two business men of Mina, Nev., under a three-way split arrangement, Mr. Mills started preliminary work in the summer of 1927, on the property he named the Container mine. Subsequent to his initial efforts, it was learned that the property had been located previously, so arrangements were made to purchase it at a compromise price from the original locator under a 25 per cent royalty agreement, the royalty being deducted from gross income from quicksilver shipments. Thus, the net return to each of the three operating partners was appreciably reduced, and there was need for the practice of economy, particularly during the early stages of development. With one helper during the preliminary stages, Mr. Mills pushed development work in the mine, built a cabin for living quarters, installed a 500-lb. "D" retort, cut several weeks' supply of cordwood, and completed preliminary arrangements before releasing his helper and starting to operate the property on a strictly one-man basis.

A list of the more important tasks performed by this efficient mine-and-reduction-plant organization in one ordinary 24-hour day is as follows:

He mines sufficient ore for two retort charges, or 1,000 lb. This is the average, of course; some days the mining is easier and a larger "poundage" is extracted; on other days the mining is more difficult and less ore is removed. The proportion of waste that must be moved per unit of ore is between five and ten to one. He transports the ore 1,000 ft. to the retort, charges the retort, and draws the calcine twice daily.

A cleanup is made of "quick" and soot. He cuts and hauls one to three cords of wood for the retort. He cooks his own meals and sees that his long-eared assistant, "Jenny," the burro, is cared for. These duties suffice to account for the larger part of the day.

To obtain maximum economy of fuel-wood consumption in the retort operation it is necessary to operate continuously. This suggests a seemingly insurmountable difficulty, but the solution effected by Mr. Mills has stood the test of successful application in practice. His method is as follows: draw calcine and charge retort at 6:30 a.m., followed by clean up of "quick" and working of soot; fire up at intervals during the day as the opportunity offers during mining operations; draw calcine, and charge again at 4:30 p.m., subsequently maintaining a hot fire until 9 or 10 p.m., which is bed time, when the fire is "banked" and the "cooking" of the charge is completed with the aid of the heat stored in the firebox lining.

The ore mineral, cinnabar, occurs in thin fissures or

seams, sometimes associated with unconsolidated sand and frequently impregnated in the country rock that lines the seams. The mine openings are little more than "gopher" holes; "following the ore" is rigorously practiced. Openings are irregular in outline and spacing, and are generally only large enough to permit a man to squeeze in and out. Gouging out the seams and pockets of higher-grade material is known as "chloriding," for which a "picky-poke bar" or "chloride-stick" is the implement of extraction. This is a steel bar, usually of $\frac{7}{8}$-in. stock, about 4 ft. long, with each end sharpened, and bent out at an angle of 45 deg., the bends being 3 to 6 in. from each end. Blasting is resorted to only as a last resort, for hand drilling is a great time consumer and timbering is avoided if possible.

While "chloriding," the ore is broken on a piece of canvas, or sacked on the spot, to avoid dilution with waste; it is carried to a point reached by wheelbarrow from the surface, wheeled outside, and loaded in a box-shaped "sled" with steel runners. "Jenny" is the motive power for this conveyance, which she hauls, downhill, about 1,000 ft. to the retort. One to three trips per day are required, normally, to transport the ore mined. The actual quicksilver recovery has been close to $2\frac{1}{2}$ per cent of the tonnage of ore charged, or 50 lb. of quicksilver per ton. During the period of operation under consideration—from Aug. 1, 1927, to Jan. 1, 1928—35 flasks of quicksilver were produced and sold for a gross yield of about $4,000, of which $1,000 was applied as payment on the property. The balance, after paying for all equipment and supplies, is split three ways, among Mills and his two backers. Starting-up expense, including the cost of equipment and construction, has been a big item in this early period of operation, but conditions appear more promising for operations in the future.

Several new ore streaks have yielded an average return, per 500-lb. retort charge, of more than 20 lb. of mercury. Under the present scheme of operation, 40 lb. of "quick" per day will yield the partners a net profit of close to $30, sufficient to assure continuation of the development and exploration work in expectation of finding high-grade ore that will yield larger profits, or opening up an extensive low-grade deposit that will permit the sale of the property to interests financially able to work it on a big-tonnage basis.

Quicksilver discoveries reported in this region recently have attracted considerable attention to the district because of the present high price for the metal. The deposits occur within a north-south zone of mineralization, on the eastern slope and paralleling the main range of the White Mountains. The principal landmark is Mount Montgomery, a few miles to the west, which is bisected by the California-Nevada boundary line. Mount Montgomery is the northernmost extremity of the White Mountain Range; beyond this point the range dwindles off into the high plateau country of western Nevada. The nearest post office is Arlemont, Esmeralda County, at the Chiatovich Ranch, in the northern end of the Fish Lake Valley, access to which is from Coaldale, a station on the Tonopah & Goldfield Railway, to the north; from Basalt, a station on the Southern Pacific narrow gage, to the northwest, by a wagon road skirting the base of Mount Montgomery; or from Big Pine, Calif., across Westgard Pass and Deep Springs Valley, and up through Fish Lake Valley from the south.

## Treating an Oxidized Silver-Gold Ore

THE OXIDIZED silver-gold ores of the Baboquivari mining district, 60 miles southwest of Tucson, Ariz., have recently been the subject of laboratory experiments by the U. S. Bureau of Mines at its Reno station. The ore shows only a very small amount of pyrite on panning, and the silver is largely associated with the black oxides of manganese. A sample analysis follows:

| | Per Cent | | Per Cent |
|---|---|---|---|
| | | Sulphur | 0.04 |
| Silica | 90.10 | | |
| Ferric oxide | 5.30 | Total | 98.46 |
| Alumina | 1.64 | | Ounces per Ton |
| Lime | 0.20 | Silver | 4.23 |
| Manganese dioxide | 1.20 | Gold | 0.275 |

The best laboratory flotation results were secured by grinding to 65 mesh and floating with xanthate or standard flotation oils, plus sodium sulphide and polysulphide. This gave a concentrate in which 32 per cent of the silver was recovered, and 80 per cent of the gold, approximately duplicating the commercial practice at a small flotation plant in the district. No instance is known of a manganese oxide ore having been concentrated satisfactorily by flotation. The following table gives detailed comparisons:

| Preliminary Treatment | Period of All-Slime Cyanide Treatment, Hours | Reagent Loss, Pounds per Ton | | Tailing Assay, Ounces per Ton | | Extraction, per Cent | |
|---|---|---|---|---|---|---|---|
| | | CaO | NaCN | Ag | Au | Ag | Au |
| None | 48 | 28 | 1.10 | 2.80 | 0.005 | 33.0 | 98.2 |
| Deoxidizing roast (producer gas) | 48 | 25 | 1.80 | 1.08 | .027 | 74.5 | 90.3 |
| Deoxidizing roast (powdered coal) | 48 | 28 | 1.20 | 1.65 | .060 | 60.9 | 78.2 |
| Sulphur dioxide (leach) | 48 | 46 | 1.00 | .65 | .013 | 84.5 | 95.1 |

Plain cyanide on the original ore extracts practically all of the gold but only one-third of the silver. A preliminary deoxidizing roast, using producer gas or powdered coal, gives a calcine, from which cyanide dissolves about 90 per cent of the gold and 75 per cent of the silver. This method of treatment, known as the Clevenger-Caron process, is described in Bureau of Mines Bulletin 226.

Preliminary treatment with sulphur dioxide by burning pyrite or sulphur and passing this gas into the pulp until all of the contained manganese is dissolved or changed in form best prepares the ore for cyanidation. The acid consumption will vary with the percentage of manganese and other soluble constituents. Neither gold nor silver is dissolved by this acid treatment. The washed residue gives maximum cyanide dissolution of the gold and silver with minimum loss of cyanide.

## Diamond-Drill Exploration

THE DIAMOND drill, as an important accessory for exploration, is receiving more and more attention. Sudbury district, where the value of the area represented by the Errington mines was thus demonstrated in advance of underground development, is an example. At the Hollinger mine, over 74,224 ft. of diamond drilling was done in 1927, in conjunction with other development work. Cananea accomplished 5,765 ft. of diamond drilling and 10,795 ft. of churn drilling in 1927. Shattuck Denn penetrated 5,895 ft. with the diamond drill in 1927. Calumet & Arizona, in the Warren property, accomplished 6,558 ft. of diamond drilling and 9,526 ft. in the Verde Central. Phelps Dodge, in its Moctezuma property, did 11,401 ft.

# *Microscopic Study of an Ore As an Aid in Copper Leaching*

By R. E. HEAD

*Microscopist, U. S. Bureau of Mines, Salt Lake City, Utah*

ALL PROCESSES devised for the beneficiation of ores have for their object the recovery of the greatest possible amount of the valuable constituents up to the point at which further expenditure of time and money would exceed the value of the added recovery. Since the physical characteristics of ores and the minerals composing them are of primary importance in selecting a method of treatment, all available agencies for obtaining these data should be utilized.

This paper deals with the physical characteristics of a sample of ore from the Castle Dome orebody of the Pinto Valley Mining Company, near Miami, Ariz., on which leaching experiments are being conducted. It gives the results of a microscopic examination of unleached and leached material and shows the value of the data secured in this manner in the interpretation of the experimental results obtained by leaching. It also emphasizes the advantages to be derived from a knowledge of the physical and structural characteristics of the rock mass in which the minerals occur, as well as of the minerals themselves.

The orebody on which tests are being made has been prospected by drilling over a considerable area and to a depth of approximately 300 ft. Analyses of drill cores indicate the existence of a large orebody that contains more than 1 per cent copper. The mineralogy of the deposit, as determined by chemical work on the drill cores, differs slightly in various zones, and the copper content in oxidized form is reported to be relatively low, and may average not far from 0.04 per cent.

The data given were obtained from a microscopic examination of samples of different sizes that had been leached with ferric sulphate and sulphuric acid solution containing 22.4 grams of ferric iron and 9.7 grams of sulphuric acid per liter. Size, copper content, and extractions obtained in this particular test are shown in the following table:

| | A Sample | B Sample | C Sample |
|---|---|---|---|
| Size, inches ..... | 2 | 1½ | 1 |
| Total copper, per cent... | 1.15 | 1.17 | 1.16 |
| Extraction, per cent .... | 71.8 | 76.1 | 76.6 |

Chemical determinations on this sample at the Tucson station indicate that it contains approximately ⅜ per cent oxide copper, about 80 per cent $Cu_2S$, and the remainder (19 per cent) as $CuFeS_2$. Copper occurring as covellite would be included in the calculation as $CuFeS_2$. The test for which the data are given was run for a period of 26 days—thirteen days at atmospheric temperature followed by washing for two days and then nine days hot leaching, followed by a final washing for two days.

In preparing the ore samples for microscopic examination, use was made of thin sections as well as polished

*Photomicrograph No. 1—Unleached ore*

Portion of a vein or fracture containing mixed copper sulphides. The light-colored center portion is chalcopyrite; the darker material immediately surrounding it is a mixture of chalcocite and covellite. The outer rim which is distinctly visible on the upper side is chalcocite. Veins of copper sulphides as represented are not continuous, but are rarely more than 1 mm. in length; the width varies from 0.12 mm. to 0.30 mm.

surfaces. Several specimens of each sample were prepared in an endeaveor to obtain representative areas, since it is evident that this type of ore might differ considerably in metal content in different parts of the orebody.

Examination of polished surfaces of the "head." or unleached, sample showed that the rock had undergone considerable alteration, and that it was also markedly fractured and broken in a fairly uniform manner. The microscope showed that the sulphide copper minerals were chalcopyrite, chalcocite, and covellite. There was also a small amount of pyritic iron in the specimens examined. As a general statement it may be said that the sulphide copper minerals occur associated with each other, although occasional particles of segregated chalcopyrite, chalcocite, and covellite were noted. The greater portion of the copper-carrying grains is made up of

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chalcopyrite surrounded by a mixture of intimately associated covellite and chalcocite. In some instances the outer ring of such a particle would consist of a narrow band of chalcocite inclosing an inner area made up of the mixed covellite and chalcocite, with the chalcopyrite as the central part, or core. There is no uniformity in this respect, however, except that the occurrence of the three minerals—that is, covellite and chalcocite surrounding chalcopyrite—is the most prevalent.

*Photomicrograph No. 2—Unleached ore*

Particle of combined or mixed sulphides. The center portion is chalcopyrite; it is surrounded by a zone of intermixed chalcocite and covellite. The channels or fractures leading to the particle have been accentuated to render their presence clearly noticeable. Dimensions of the particle are approximately 0.36 mm. by 0.20 mm.

It is a striking fact that these sulphides almost invariably occur along shattered portions of the rock and in fractures leading from the more pronounced broken areas. These fractures are well marked and indicate that the material would break readily along these zones of weakness. This would also further suggest that breakage along these fractured planes would expose the sulphide minerals to contact with solution much better than if leaching were practiced on large pieces of ore. In going over several of the polished surfaces it appeared that this fracturing was so uniform that an estimate could be made of the "critical" size to which the rock would break with a very small amount of crushing, and that in its already partly fractured condition, a slight blow would break up any 2-in. or 3-in. specimen into smaller pieces having a minimum size governed by the extent of incipient fracturing that already existed. This size would be somewhere in the neighborhood of ½ in. or slightly larger on the samples examined, the smaller size being fairly close to the minimum that would result from the modified crushing.

Examination of thin sections of this unleached material showed that the feldspars had largely altered to sericite mica, and that the greater decomposition was evident along and in close proximity to the fractures in the rock; also, that a predominating number of the sulphide copper particles were either associated with or were very close to these decomposed feldspar areas. The physical characteristics of sericite are its extremely fine state of division and claylike nature. This fact is of interest in connection with the attempted leaching of the copper sulphides in ore of the coarser sizes. This matter will be noted later.

### Microscopic Examination of Leached Samples

Polished sections of Sample A showed hte same characteristics of fracturing that were noted in the study of the unleached ore samples. The sulphide particles occurred in the same relation to the fractures; and it follows as a matter of fact that leaching solutions had penetrated along these fractures in practically all specimens examined. The evidence that leaching solutions had permeated along the fractures was chiefly manifested by the showing of oxidized iron and also by the discoloration of sericitic areas. These micaceous areas were discolored and slightly yellowish. In polished section, under the light conditions used, the siliceous areas reflected light and the sericitic portions could be readily determined from the fact that they were dull and nonreflective. In this way the association of the sericitic areas and the sulphides, as well as their relation to the fractures, could be readily observed.

In instances where solutions had penetrated along fractures of considerable size there was evidence that the chalcocite and covellite portions of the sulphide particles had been partly or wholly removed, leaving the inner core of chalcopyrite. In such formations the chalcopyrite did not, in many instances, show any marked effect of contact with the solution; that is, it appeared as bright when polished as did the chalcopyrite in the unleached samples. In some specimens, however, the chalcopyrite was considerably darker than in the unleached samples, which may be taken to indicate that some change might have taken place.

There appears to have been no marked uniformity of dissolution of the copper sulphide particles, however, since numerous areas were found along fairly distinct fracture planes which were composed of chalcocite, covellite, and chalcopyrite, as described under the unleached material. There were many indications that the outer chalcocite surface mentioned before, as well as some chalcocite which occurred intermixed with the covellite, had been taken into solution. Furthermore, many grains which consisted of covellite and chalcopyrite were found; the covellite in all cases occurred as a shell surrounding the chalcopyrite. Such particles may represent the residue remaining after the dissolution of a chalcocite shell, but this could not be conclusively determined except in instances where a marked vug had been formed by removal of the chalcocite.

Examination of thin sections confirmed the observations enumerated in regard to the effect of leaching solutions on the sulphides and on the sericite mica, but did not give any information in addition to that obtained by the study of polished surfaces.

### Little Chalcopyrite Dissolved

Surfaces of the specimens from Samples B and C were studied in the same manner and showed characteristics similar to those described. In no examination did any one specimen show that all the sulphide copper had been removed, and it is fairly certain that no great amount of copper combined as chalcopyrite had been leached during the time of contact. As will be noted later, all of the small pieces of ore approaching ½-in. size were picked for chemical analysis, and in consequence no small pieces were examined microscopically to deter-

mine if the copper had been entirely removed from this type of material. All specimens examined showed chalcocite, covellite, and chalcopyrite, although there was a marked decrease in the amount of chalcocite present in the leached ore. The covellite, however, appeared to be almost as abundant in quantity as did the chalcopyrite.

After the microscopic work was completed, it was thought that there would be a gradual decrease in the copper content shown by the lump samples as their size diminished. This assumption was based on the fact that in finer crushing breakage would occur along natural fractures, and that the sulphide particles would be directly exposed to solution contact and would therefore dissolve much more readily than where contact had been obtained by the penetration of solutions along fractures and through areas of sericite mica. A composite sample was therefore prepared, made up of the small pieces picked from the different leached samples and averaging about ½ in. in size. These pieces were not broken from the larger samples, but were portions of the finer material that was intermixed with the larger size pieces. Determination of copper on this composite leached sample of A, B, and C showed a copper content of 0.44 per cent.

*Photomicrograph No. 3—Leached ore*

This shows a particle which is directly in a channel and which has been in direct contact with the leach liquor. The outer portion of this particle is gray and was probably composed of mixed chalcocite and covellite, as shown in photomicrographs 1 and 2. The chalcopyrite portions of the particle are slightly darker than normal chalcopyrite, which may indicate incipient decomposition. Such action has been exceedingly limited, however, since the surface polishes well and appears homogeneous. The size of the particle is approximately 0.42 mm. by 0.40 mm.

Although too much importance cannot be attached to the results given, owing to the difficulty in picking representative material, it would seem to indicate that better results in leaching would be obtained on material of approximately ½-in. size, as was indicated by the relationship and abundance of fractures noted in the description of the larger size ore samples. Disseminated copper sulphide particles in the specimens examined were seldom associated with fractures, and therefore had not been reached by leached solutions. Such particles were unaffected during the 26-day leaching period. It is doubtful whether these disseminated particles would be reached and affected by leaching solutions except under conditions of extremely long-time contact, or when released by fine grinding, which would probably not be practicable. Fortunately, these disseminated particles represent only a small percentage, and failure to recover their copper content would probably represent a comparatively small loss unless the character of the orebody changed materially from that represented by the samples which were studied and disseminated particles became more abundant. In general, the bulk of the sulphide particles are not of extremely small size, and it is approximated that a material portion of them are larger than 100 mesh, and in some instances attain a size approaching 20 mesh, although the larger particles are not very abundant.

## Summary

It may be assumed with reasonable certainty:

1—That the sulphide copper in ore represented by the samples examined occurs quite uniformly as chalcocite, covellite, and chalcopyrite, all being closely associated.

2—That the major portion of the sulphide copper minerals occurs in broken portions of the rock along fractures and that they are therefore arranged in a fairly connected manner through the ore.

3—That in mixed particles chalcopyrite almost invariably occurs as the core, or center, surrounded either by covellite or, more generally, a mixture of chalcocite and covellite.

4—That the nature of the fracturing indicates clearly that the openings resulting therefrom act as channels through which solutions are carried to the sulphide particles except in cases where they are disseminated as particles of very small size. Such particles have not been reached by fractures and will require a longer period of leaching. In connection with this statement it is important to note that, in the samples studied, a relatively small quantity of copper is represented by disseminated particles and that they are uniformly small in size.

5—That areas of decomposed feldspar in the form of sericite are usually closely associated with, or in contact with, many of the sulphide areas.

6—That the extent to which solutions have permeated the leached samples is shown by discoloration of the sericitic areas and also by the oxidized iron stains remaining in the fractures.

7—That sulphide particles entirely surrounded with the claylike or slimy sericite appear to be rendered less permeable to solution than those in more siliceous formations and that reaction between the copper mineral and the leach liquor may thereby be considerably delayed and require a much longer time of contact under these conditions.

8—That the chemical determination of copper made on the ½-in. size material suggests that leaching will progress faster in the ore where the fracturing has been extremely pronounced, thus creating numerous channels through which solutions can penetrate.

9—That the microscopic work done indicates that the extent and nature of the fracturing, together with the composition and mode of occurrence of the copper sulphides, are important considerations in conducting leaching operations on an ore of the type described. It also emphasizes the value of microscopic study in procuring data that cannot be obtained by chemical methods of investigation.

# *Bromocyanide Treatment of Telluride Concentrate at Wright-Hargreaves*

By J. T. WILLEY

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*Kirkland Lake, Ont.*

A VARYING amount of tellurides occurs in the ore of the Wright-Hargreaves mine at Kirkland Lake, Ont. During the summer of 1925 the practice of concentrating during cyanidation and of treating the concentrate with bromocyanide was begun. The steps of the procedure are as follows:

Concentration is effected by running the classifier overflow through a K. & K. flotation machine without the addition of oil or reagents. The concentrate, together with froth that is scraped at intervals from the Callow cones used in connection with the fine grinding, is delivered to a tank, 12 ft. in diameter and 10 ft. high. Two of these tanks are used, one filling while the treatment process is being conducted in the other. The concentrate settles on entering the tank, the solution being decanted off continuously. When the tank is full, or nearly full, of concentrate the flow is diverted into the second tank and agitation of the charge in the first tank begun. The charge thus accumulated is about 15 tons of slime and concentrate and 15 tons of solution, or 30 tons in all.

Agitation is effected mechanically, the arms making 10 revolutions per minute, and is continued until the charge is thoroughly mixed. Specific gravity and moisture determinations are then made and a sample is taken for assay.

The alkalinity of the charge is next determined, sulphuric acid being added, if necessary, to bring it down to about one-tenth. Sufficient potassium cyanide is then added to bring the strength of the solution up to 1 lb. per ton.

The charge is now ready for treatment with bromocyanide, which is prepared by mixing definite proportions of Dow's mining salts, Cassel's cyanide, and sulphuric acid. To make 1 lb. of bromocyanide the following quantities of the three ingredients are used:

| Material | Grams | C.C. Water |
|---|---|---|
| Mining salts | 521 | 1,500 |
| Cassel's cyanide | 207 | 1,500 |
| Sulphuric acid (66 deg. Bé.) | 484 | 4,500 |

Dow's salts are a mixture of sodium bromide and sodium bromate in such proportions as to produce the maximum quantity of bromine when dissolved and sulphuric acid or a similar acid is added. The bromine, when liberated, combines with cyanide to form bromocyanide, which is effective in the extraction of gold from certain ores.

These salts are made by the Dow Chemical Company, Midland, Mich. At present, the manufacturer is supplying them in Canada through Peacock Brothers, Ltd., which has its principal office at 1605 Delorimier Ave., Montreal, and a branch at Cobalt. The Dow company has also supplied large quantities of the material to a mining concern in Fremantle, Australia.

Twenty pounds of bromocyanide mixture, made according to the recipe given, are now prepared for addition to the charge. The mixing of the three ingredients is carried out in the following manner:

Three 40-gal. barrels are used. Into the first, which is immediately above the agitating tank, is put the sulphuric acid, in the desired quantity. For 20 lb. of bromocyanide this will be twenty times the quantity of acid and water given in the recipe. The other two barrels stand immediately above the sulphuric acid barrel. From the bottom of each a lead pipe runs down into the lower barrel, which in turn has a lead discharge pipe running into the agitating tank. Plugs serve as valves. The sulphuric acid barrel is covered to reduce the annoyance from fumes on mixing. It is also provided with a mixing device, the handle of which projects upward through the cover. Into one of the upper two barrels is placed twenty times the quantity of mining salts and water given in the recipe, and in the other the equivalent amount of potassium cyanide and water. The salts and the cyanide are then dissolved in their respective barrels. The contents of the three barrels are now ready for mixing. This is done by pulling the plugs simultaneously in the upper two barrels and allowing their contents to run down into the sulphuric acid in the covered barrel below, at the same time stirring or agitating the latter's contents to insure thorough mixing. (Operators should remember that any free acid on coming in contact with a cyanide salt will produce an evolution of hydrocyanic acid, which is deadly poisonous.—EDITOR.)

The 20-lb. lot of bromocyanide thus prepared is now discharged from the lower barrel into the 30 tons of concentrate and water in the agitator. This is usually done early in the day. Agitation of the charge continues until the following morning. The concentrate is then sampled, and if the assay shows that its gold content is still high, another 20-lb. lot of bromocyanide is prepared and added, and agitation continued until the following day, when a sample is again taken. The cycle of operations is repeated until, on sampling, the extraction is shown to be approaching that desired (dollar tailing is considered satisfactory). Then a 10-lb. lot of bromocyanide usually suffices to complete the extraction. For the given charge, namely 15 tons of concentrate and 15 tons of water, approximately 70 lb. of bromocyanide (in three 20-lb. charges and one 10-lb. charge) has generally been found sufficient. Although a dollar tailing is satisfactory, the tailing loss can be reduced to any desired point. The question of cost must be considered, however.

Experience has shown that the desired extraction can be obtained in six hours from the time the first bromocyanide is added, if continuous attention be given the operation. That is to say, prolonged agitation is unnecessary. However, it is more convenient at this mill from the operating viewpoint to conduct the treatment in the manner described.

When the extraction is completed, the entire charge of concentrate and solution in the tank is discharged into the secondary thickeners of the mill circuit.

Data covering the bromocyanide treatment for a typical month (July, 1927) are given in the following:

**Data on Treatment of Telluride Concentrate**

| | |
|---|---|
| Tons concentrate treated | 70.55 |
| Assay value per ton, calculated | $74.55 |
| Assay value per ton, by assay | $76.087 |
| Gold to mill | $5,154.23 |
| Total gross value calculated | $5,260.16 |
| Total gross value by assay | $5,367.96 |
| Assay value of tailing per ton | $1.501 |
| Total assay value of tailing | $105.93 |
| Percentage extraction, by assay | 97.987 |
| Percentage extraction, calculated | 98.021 |

It might be added that the specific gravity of the pulp is not of moment so long as the tank is full. A one-to-one pulp, such as has been considered, has been found convenient. The specific gravity is determined simply to permit the calculation of tonnage.

## Production of Soda and Borax Salts Shows Big Increase

PRODUCTION of sodium compounds, not including common salt, from natural salines and brines in this country in 1927, as indicated by sales or shipments by producers, amounted to 145,770 tons, valued at $3,834,-324, according to the U. S. Bureau of Mines. These figures include the output of sodium carbonate (soda ash), sodium bicarbonate, sodium sulphate (salt cake and glaubers salts), trona, and sodium borate (borax and kernite), and show a large increase in both quantity and value compared with 1926, partly on account of the recent development of kernite deposits.

The sodium carbonates reported were all from California and amounted to 67,240 tons, valued at $1,253,352. They were produced from Owens Lake, Inyo County, by the Clark Chemical Company, Lone Pine (soda ash); the Inyo Chemical Company, Lone Pine, (soda ash, sodium bicarbonate, and trona); and the Natural Soda Products Company, Keeler, (soda ash, sodium bicarbonate, and trona); and from Searles Lake, San Bernardino County, by West End Chemical Company, West End, (sodium bicarbonate).

Sales of sodium sulphate amounted to 23,080 tons, valued at $168,882. Sodium sulphate (salt cake) was produced at Clarksdale (P. O. Camp Verde), Yavapai County, Ariz., by the Sodium Products Corporation; at Wabuska, Lyon County, Nev., by the American Sodium Company; and at Monse, Okanogan County, Wash., by the Naso Chemical Company. Hydrated sodium sulphate (glaubers salt) was produced at Casper, Laramie County, Wyo., by D. W. Gill.

Sodium borate, as borax, was produced from Searles Lake brines in San Bernardino County, Calif., by the American Potash & Chemical Company at Trona, and by Burnham Chemical Company and West End Chemical Company at West End. Sodium borate, as kernite, was mined by the Pacific Coast Borax Company from the Baker deposits, in Kern County, near Barstow, Calif.

Colemanite (calcium borate) was mined at the Ryan Mines, Death Valley Junction, Calif., by the Pacific Coast Borax Company; at the Gerstley plant, Shoshone, Calif., by C. M. Rasor; and at the Anniversary mine, Las Vegas, Nev., by the West End Chemical Company.

The total boron minerals shipped in 1927 amounted to 109,080 tons, valued at $3,473,399.

## Embrittlement of Boiler Plate

EMBRITTLEMENT of boiler plate is a term used to designate the weakening of the metal structure of boiler plate by the action of certain chemicals. In Bulletin 177 of the Engineering Experiment Station, University of Illinois, the investigation of serious cases of boiler failures, arising from embrittlement of the metal, resulted in the following conclusions:

(1) Embrittlement in boiler plate is caused by the combined action of stress and chemical attack. The stresses are inherent in the construction and operation of the boiler, while the chemical attack is caused by the presence of sodium hydroxide in the boiler water.

(2) Certain methods of water treatment tend to convert some safe waters into the characteristic type which produces embrittlement.

(3) The presence of sodium sulphate in the feed water tends to retard the embrittling effect of sodium carbonate feed waters and if in proper proportions will stop it.

(4) The presence of phosphates, tannates, chromates, acetates, etc., will also inhibit the embrittling action of caustic soda if these salts are present in the boiler water in proper amounts.

(5) Methods for the introduction of these inhibiting agents to feed waters have been worked out and are in operation in large power plants.

(6) No steel suitable for boiler plate has been found resistant to the embrittling action of caustic soda.

### *Catering for the "Inner" Man*

**A PROCESS manufacturer has made a "hit" by advertising that his product comes originally from contented animals. It is equally important that human employees are kept contented, and a sharp watch maintained for any possible source of dissatisfaction. Clean, appetizing, and nutritious food is no longer a luxury, and the mine boarding house has become an important factor in the establishment of healthful conditions and more cordial relations. Our western editor at Salt Lake City, Mr. H. D. Keiser, will describe in a forthcoming issue of *Engineering and Mining Journal* the Keetley boarding house of the Park Utah Consolidated Mines Company, which may well be taken as a model by those concerns that have not yet given adequate attention to this important phase of industrial operations.**

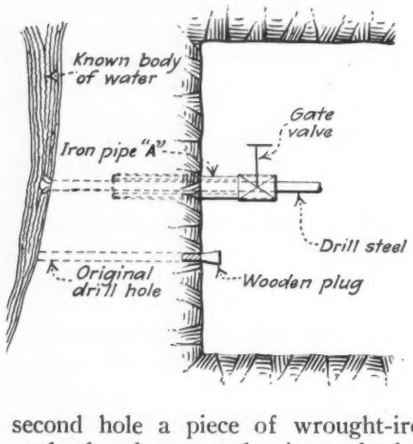
# USEFUL OPERATING IDEAS

## Controlling Water Flow in Heading

By Roy H. Poston

**IDEA No. 1**

IN DRIVING a heading in a Southeast Missouri lead mine, the drill tapped a body of water under such pressure that it would have given trouble if released before means for controlling it had been provided. This was done as shown in the sketch. After plugging the original drill hole tightly, another and larger hole was started immediately above it and was drilled approximately one-half the depth of the first. In this second hole a piece of wrought-iron pipe was firmly wedged and cemented. A standard gate valve was fitted to the outside end of the pipe. After the cement had set, the gate valve was opened and a hole drilled through the cement deep enough to tap the water. This hole was drilled by inserting the rock-drill steel in and through the gate valve and the pipe so as to deepen the hole already drilled. On tapping the water, the steel was withdrawn and the gate valve closed.



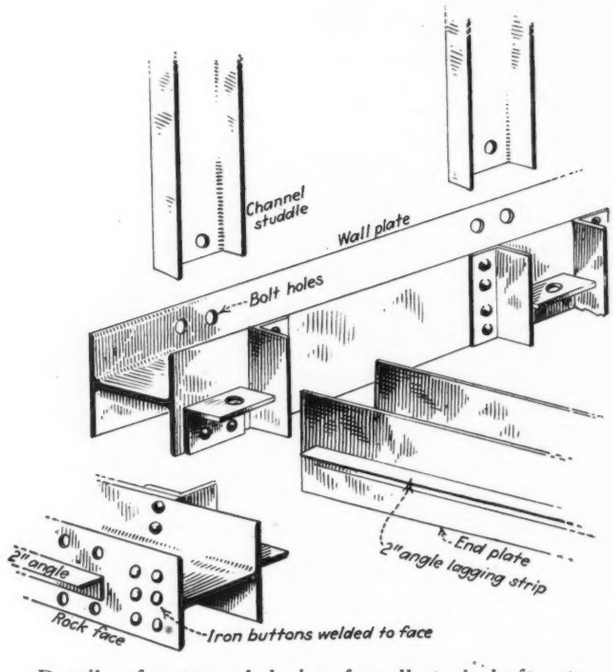

*Method of controlling water flow tapped in heading*

## Steel Shaft Sets

**IDEA No. 2**

IT IS a fact that the all-steel shaft set has never become established in any general way. Some shafts have been supported by steel sets, and steel is occasionally used for guides and dividers in concrete-lined shafts. Reinforcing steel is used in concrete work, and structural steel—that is, H-beams—is sometimes employed at crossings or where wide spans are necessary in development workings. Rust, difficulty of handling, and cost are the principal reasons for the lack of enthusiasm about steel for shaft support. If a satisfactory rust-proofing for underground conditions were available perhaps more or less steel would be used in shaft construction under special conditions.

A short time ago *Engineering and Mining Journal* was asked for suggestions as to methods of framing steel shaft sets, and a search was made for details, but no very illuminating examples were found. However, the accompanying sketches were made and are here presented as a starting point for the design of all-steel sets. The H-section, of dimensions and weights to correspond to the needs of the situation, is taken as a base. Wall plates, end plates, and dividers are of the same cross-section. The wall plates are to be punched for hanging bolts in pairs of holes at two or more points, as in the use of timber sets. A special form of socket wrench will be necessary for tightening nuts upon hanging bolts. The joint between end plate and wall plate is made by a supporting angle-bracket riveted to the wall plate and punched to correspond with a hole in the web of the end plate. A bolt is used to fasten the end plate to the angle upon the wall plate. To take the thrust upon the end plate a heavy angle is riveted to the wall plate as shown. Dividers are supported by a horizontal angle and bolt, and, in addition, a vertical piece of angle iron is riveted to the wall plate on each side of the divider as shown in the sketch. Studdles, or vertical "posts" at the corners and at dividers, can be made of channels bolted to the outer flange of the wall plate. In place of these, timbers can be used and secured at top and bottom by angles welded to the web of the wall plate. With the channels, hanging bolts may not be necessary, as the wall plates can be suspended by the bolted channels and, when secured, the end plates and dividers can be placed in position and secured by bolts. The blocking of the set at the corners presents a difficulty. It is suggested that small "nobs" be welded to the outer surface of the wall plate to afford a bearing for the blocking. When the




*Details of proposed design for all-steel shaft sets*

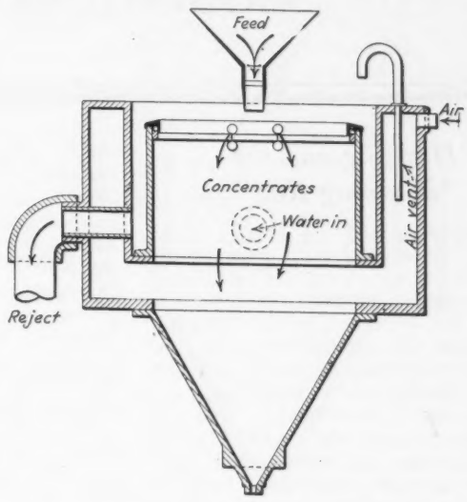
block is wedged these will sink into the end of the wood and secure it in position. Lagging strips consisting of angles can be welded to the wall and end plates.

Probably the weakest place in the suggested design is the support of the end plates against horizontal thrust. A heavy unequal leg angle secured by a sufficient number of rivets to develop the full strength of the end plate when reacting as a beam could be used. The weight of such a set for three 4½x5-ft. compartments is estimated at 2,600 lb. for 8-in. H-beams, 34 lb. per foot. The weight of steel would be about 435 ft. per foot of shaft for sets approximately 6-ft. centers. Bearers would be required at intervals to carry part of the weight of the sets.

## A Jig for Concentrating Diamonds

**IDEA No. 3**

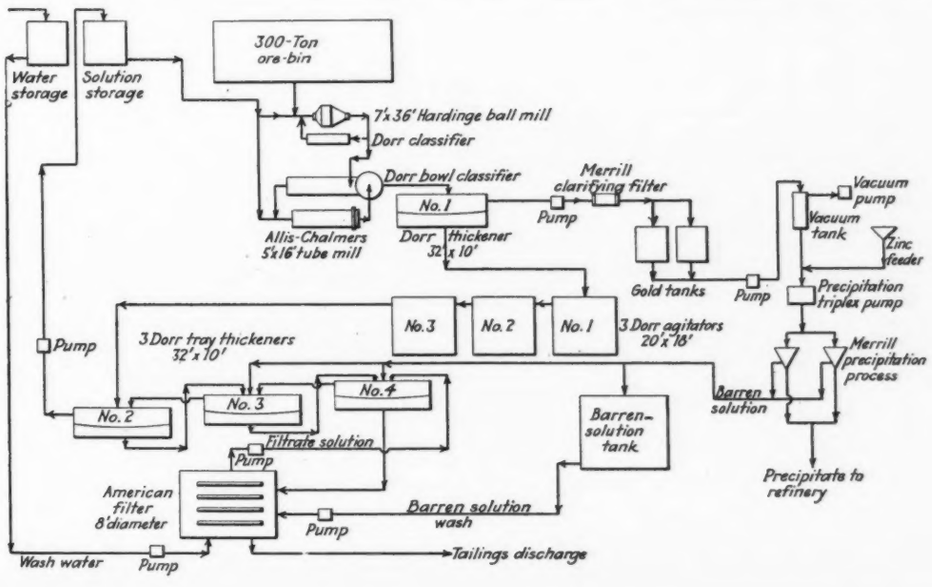
COASTAL diamonds in Southwest Africa are not amenable to the usual grease separation, possibly owing to some very thin coating, the nature of which is as yet undetermined, according to the *South African Mining and Engineering Journal*. Much research has been applied to the development of a suitable concentrating apparatus. A jig of the Schiechel type, locally known as the "Schickel pot," has been developed to a satisfactory state of efficiency. This jig, which is shown in the accompanying sketch, has been evolved from a laboratory jig originally designed by Büttenbach. It consists essentially of an external cast-iron vessel made up of two cylinders, the inner one being joined to the outer at the top, forming a sealed annulus. Mounted on the bottom flange of the inner cylinder is a bronze cylinder carrying a special round screen at the top. The screen is pierced by small holes which permit the passage of water, and by larger holes sealed by valves consisting of two wooden balls connected by a wire. A space is formed between the bronze cylinder and the inner cast-iron cylinder which is connected to a waste outlet as shown. The vessel is kept filled with water through an inlet in the outer cylinder wall. The sealed annulus is connected to a special type of reciprocating air compressor, whose action conveys a pulsating movement to the water contained in the pot. Gravel is fed, as indicated, to the screen. The pulsations are effective in bringing the diamonds and heavier pebbles into a bottom layer on the screen. Each upward movement of the water lifts the wooden valves, and, while they are thus momentarily open, the concentrates fall through the




*Concentrating jig of the Schiechel type developed to treat diamonds not amenable to grease separation*

openings into the bottom cone, where they accumulate. Periodically they are drawn off and taken by belt and elevator to another series of storage bins.

Two pots are worked in series as a precautionary measure, but it is said that a diamond very seldom finds its way past the first pot. The concentrates are drawn off in small quantities into similar jigs, whose screws are pierced for water only, and subjected to the pulsating action for a short time, after which the screens are carried to the sorting tables and their contents turned out upside down thereon, with practically no disturbance. The diamonds are regularly found at or near the surface of the resulting heap, within a circle of 3 or 4 in. of the center. It is planned to treat the sorted contents of the tables in a magnetic separator, the cleaned product to be returned to the circuit.




*Flow sheet of cyanide plant of Ankerite Gold Mines, Ltd., South Porcupine, Ontario*

# COMMENT AND CRITICISM

## *Dowsing and the "Divining Rod"*

THE EDITOR:

Sir—I have read with interest Mr. Rickard's review of "A Critical Study of Dowsing," and mean to possess a copy of Sir William's book. It would seem, from the number of pages, that Sir William has had a pretty tough time of it in disposing of the little "rod," and my curiosity is awakened to know in more detail about the various mechanisms and the methods of "diviners."

You will possibly recall the brief account I gave you a few months ago of seeing for the only time in my life the use of the so-called "rod," on which occasion a fine supply of water was located by use of a forked twig, and even the depth given within a couple of feet. The location was made by a man of much above the usual intelligence whose home was in the Middle West and who had never before been within 100 miles of the spot, knowing nothing whatever of the geology. The question unexpectedly arose as to water supply for a commercial purpose, and there being no visible source of supply in evidence, he volunteered to see what the "switch" would have to say. He accordingly snipped one from the nearest oak sapling, trimmed it to the proper shape, and, holding one branch of the fork in each hand, with the crotch of the twig or switch directed upward, he began to walk slowly about. Within the space of five minutes we saw the fork moving slowly forward and downward. The party stopped, and when it pointed directly down, the "locator" righted it again by a simple movement of the hands, and it went down again in the same manner as before. He repeated this a certain number of times, until it was no longer drawn downward. He then remarked that he thought plenty of water would be found at that point at about a certain depth, which he specified.

I whipped a postcard from my pocket, placed my address on it, and handed it to the driller, asking him to give me his result after drilling. A stake was driven at the exact spot, and in a few days I received a card from the driller: "Plenty of good water at 42 ft." This distance was within a foot or two of the "twig" figure.

I asked the "dowser" for his explanation of the phenomenon. His reply was simple, and it was not so very difficult to understand how it might be the correct one: "The sap in the freshly cut switch acts as a "terminal" and it is drawn by the water in the ground, especially if it is moving water, on the theory of a special attraction of like for like. The human body is a sort of electric machine, and there is a certain potential, created, perchance, by the interposition of the body between the sap and the switch and the stream in the ground. And the expression of this potential is the "dipping" of the fork. When it stops dipping the potential is simply "equalized." That potential may differ with different persons, depending upon the degree of conductivity of their tissues, which varies greatly in different people. In many the conductivity is so poor that the switch will not dip at all. If the operator has rubbers on his feet, or if he stands on glass, the switch will not dip. Psychology has nothing to do with the process, save that one must be sufficiently open minded and patient to persevere, even if not a very perfect conductor. One must keep cool and hold the imagination firmly in check, so as not to mistake a fancied "pull" for a real one.

Let us have more facts from actual experience. It is upon facts that improvements are based. These are days of improvements, and by a proper study of the available data by the unprejudiced, it may be found that the principle of the forked twig may yet yield an improved "divining rod," which may have a like destiny to "the stone that the builders rejected."

*Baltimore, Md.* A. B. BIBBINS.

## *Manganese Ore in Greece*

THE EDITOR:

Sir—The mining of manganese dioxide ore in Greece started about 40 years ago, in Messinia, near the ancient city of Ithomi. Exact statistics are lacking, but it is known that the ore was then acceptable in the European markets because of its excellent quality. Transportation difficulties seem to explain why, after two years' work, the mines were abandoned, when ore from the Caucasian Tchiatouri district first came on the market with its low price and desirable qualities. Since then nothing has been done in the Messinia district, and a good opportunity was missed to sell ore at a high price during the war.

All the southwestern part of Greece, beginning with the Olympia district and down to Cape Akritas, is undoubtedly manganiferous, but the impregnations are not everywhere strong enough to justify mining development. At some places, as in Arcadia, in Messinia and down to the south on Lycodimon mountain, outcrops of dioxide justify the erection of washing plants, as is the case in Zerbissia (Messinia district) where the A. Despositos & Company is beginning the production of high grade (87 to 90 per cent) washed ore. As a rule, the Greek dioxide ore is free from iron and phosphorus.

Another undeveloped dioxide mine is found on the island of Cephalonia, where surface ore shows 94 per cent $MnO_2$ with no phosphorus and only traces of iron oxide. Outcrops are strong there. This high-grade ore is most suitable for radio batteries.

PANAGHI LYKIARDOPOULO.

*Athens, Greece.*

## *Helium Now Available Commercially—Its Properties Are Outlined*

THE EDITOR:

Sir—Possibly some of your readers will be interested in a brief outline of some of the uses and characteristics of helium gas as well as in the fact that it is now available commercially. It has heretofore been considered a rare element and not obtainable on the open market, but is now available in commercial quantities. Unusual interest is being manifested in its physical and chemical characteristics in the field of science, and because of its unusual properties it is expected that new fields of usefulness will be discovered and developed for the benefit of industry.

The story of helium affords a striking example of the way in which unexpected returns accrue from fundamental research. The gas was first discovered in the sun through spectroscopic observation by Janssen and Lockyear at the time of the solar eclipse of Aug. 18, 1868. In 1895, Ramsey, searching for additional sources of the newly discovered element argon, discovered traces of helium in the mineral cleveite. Later, traces of helium were found in Canada and still later in France. It was observed that helium was always found in natural gas in the vicinity of minerals of a radioactive nature. During the World War, Dr. Ramsey suggested to our War Department that the department seek helium in certain natural-gas fields where the radioactive minerals were present. His theory proved to be correct, and the search for helium was successful. An extraction plant was then erected in Texas to supply helium exclusively for the United States government.

More recently, helium has been made available commercially by the discovery

of new natural-gas fields having a higher helium content and the development of an improved process of extraction by The Helium Company, whose plant is at Dexter, Kan., with headquarters at Louisville, Ky.

The first and most important use of helium so far is for inflating dirigible and passenger balloons, of the Shenandoah and Los Angeles type. Because of the fire and explosion hazard, the use of a combustible gas for inflating passenger balloons has been forbidden by the United States government. Helium is absolutely non-inflammable, and its lifting power is but little less than that of hydrogen. Because of these two characteristics—lightness and non-inflammability—it is also being used extensively for filling toy balloons that float in air, for advertising, entertainment, and amusement purposes.

Another development is the use of helium to make a synthetic atmosphere of oxygen and helium for deep-sea diving and caisson work involving labor under abnormally high pressure. The use of helium for this purpose minimizes the danger of "the bends" or "caisson sickness." This extremely painful and sometimes fatal ailment is believed to be due to the release of nitrogen, previously dissolved in the blood, by excess pressure. The advantage of helium in this instance is that it is not only more inert than nitrogen, but has the lowest solubility in water of any gas known. The tendency therefore is to increase the limits of the pressure at which work of this kind can be performed—greater depths in diving work, for instance. It also lessens the time of compression and decompression of the operator, which is an important factor.

Helium not only has low solubility in water, but is also practically insoluble in molten metals. For this reason, it is used in preference to other non-oxidizing gases, such as nitrogen and hydrogen, in annealing processes and metallurgical operations. It is also used as a damper for nautical and other scientific instruments because of its high viscosity, which is greater than air; its high thermal conductivity, which is more than six times that of air; its high specific heat, low dielectric constant, and other advantageous factors. It is being used for filling radio tubes and glow lamps and tubes for signs and as a cooling medium in electric transformers and high-speed generators. Helium has the lowest boiling point known — 267.9 deg. C.

Drying operations is another field in which helium can be utilized to speed up operations and make products of superior quality. Water and other solvents have a higher vapor pressure, and consequently will evaporate more rapidly in an atmosphere of helium than in the air or a vacuum. Because it is chemically inert, has high heat conductivity and low density, and can therefore be circulated rapidly, it is particularly suitable for drying organic and inorganic chemicals quickly and efficiently.

So far, the field of usefulness of helium has been developed because of its low specific gravity, its chemical inertness, and its low solubility. Some of the other properties are undoubtedly of equal importance, and developments in industry can therefore be anticipated with the aid of scientific research in new directions.

R. V. GARDNER,
The Helium Company.
*Louisville, Ky.*

## *Music and the Discovery of Ore*

THE EDITOR:

Sir—The use of wave lengths and harmony to discover ore was developed in Mexico more than twenty years ago. Our milling ore was of average grade, but now and then we would find a streak between the vein and the hanging wall that was practically just gold dust and a little dirt. Sometimes we got this ore; often somebody else got it first.

Having no radio or even a working knowledge of high frequencies, we used just plain music. The quality of the music was not as important as the quantity. Wind and stringed instruments were equally effective. Observations were generally made on a Sunday morning. An ordinary mining engineer could follow the technique and work out the equations.

On Sunday morning you went to the Plaza. No music: no ore. One band playing: check up on the drunk hiring the music. If a mill man: pass word to the superintendent that he be fired. If a miner: check up on the face he is working.

One Sunday morning we found twelve separate orchestras playing in the Plaza at one time. We needed no expert to tell us we were in bonanza. One glance at the men by our mine foreman and we were off to the mine and sacking high grade within an hour.

BENNETT R. BATES.
*Los Angeles, Calif.*

## *Air Blast in Quincy Mine*

THE EDITOR:

Sir—With reference to the account of the disaster at the Quincy mine in your issue of Nov. 5, 1927: What are known as air blasts, rocks bursts, or pressure bursts are brought about by the explosive release of violent stresses in the rock. Similar stresses in the rock are the underlying causes of earthquakes. The Meteor Mountain Crater in Arizona, and other craters, old and new, spread the world over, are the outcome of what must be looked upon as enormous rock bursts or pressure bursts.

At the Meteor Mountain Crater there has been a close connection between the formation of the nickeliferous iron and the alteration in the state of tension conditions in the rock.

*Tromsø, Norway.* G. HENRIKSEN.

# Consultation

## Free Silica and Insoluble

*"Between two mining entities the question is being discussed as to whether it may be considered general practice that free silica in ore should be considered as insoluble, in case the smelting contract contains a clause to the effect that 'insolubles over "x" per cent pay a penalty of "y" cents per unit.' We would thank you indeed for giving us your opinion on the subject."*

YOUR inquiry regarding the terms, "free silica" and "insoluble," is somewhat ambiguous. Free silica is included in what is known as insoluble. On the other hand, insoluble may, and usually does, contain other substances also, such as refractory silicates, so that if a smelter contract provides a penalty on a certain percentage of insoluble, it will not be proper to assume that the penalty can be regulated by the free silica content alone.

The term insoluble is a common one, but is meaningless unless the assaying procedure is thoroughly understood. Obviously, a substance will be more soluble the more strenuous are the measures taken to get it into solution. Fortunately, most assayers follow the same procedure in its determination, and results secured by independent assayers usually check fairly well, or within permissible limits. The insoluble is usually considered as siliceous matter that does not go into solution readily when treated by hydrochloric acid (plus in some cases nitric or sulphuric acid), followed by baking, and treatment of the residue with hydrochloric acid.

## What Is a Unit?

*"In the market report of E. & M. J., I note that you quote a number of different ores and products, such as tantalum ore for example, per unit of mineral or metal content. What is a unit?"*

THE *unit* used in these quotations is the percentage unit—that is, a short-ton unit is 1 per cent or 20 lb.; similarly, the long-ton unit is 22.4 lb. In a recent issue, tantalum ore was quoted as follows: Per short-ton unit of combined $Ta_2O_5$ and $Cb_2O_5$, basis 65 per cent ore, $30. To elaborate, this means that the basis of negotiation is a product containing 65 per cent combined tantalite and columbite, that the value of the combined tantalite and columbite is $30 per short ton unit, or $1.50 per pound, and the value of one ton of such ore, analyzing exactly 65 per cent combined $Ta_2O_5$ and $Cb_2O_5$, on the basis of this quotation, would be $1,950.

# INDUSTRIAL PROGRESS

## The Equipment Review

*A Porous Medium for Flotation Cells—An Apron Feeder Designed for a Mexican Mine*

A POROUS medium that will withstand considerable abrasion and at the same time, with low air pressure, deliver a flow of air uniformly over a surface covered with water, has recently been devised by F. C. Dyer and H. L. McClelland at Toronto, Canada. Its qualities make it suitable for use as a flotation blanket, among other purposes. Much experimenting was done before a way of making the desired medium, as well as a material from which to manufacture it, was found.

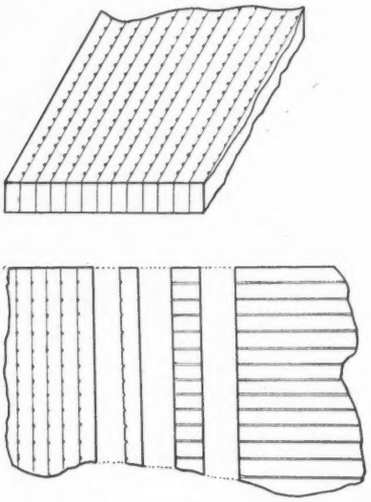


*Fig. 1—Sketch showing arrangement of grooved strips to form the new porous medium*

The material finally adopted was the uncured mixture of cork and oils from which linoleum is made. It was obtained from the Dominion Oil Cloth Company. The method of manufacturing the medium was to roll the raw material into strips with a roll provided with ridges to form grooves. The strips were then arranged so that a grooved face was against a smooth face, forming a porus sheet of a thickness equal to the width of the strips (Fig. 1). The raw material was cut up, granulated, and heated with an old-fashioned crimping roll until soft and sticky, and then passed through a roll provided with longitudinal ridges for impressing grooves in the material. (Fig. 2).

Subsequently the roll was changed for another with the ridges around the roll instead of lengthwise on it (Fig. 3). The sheet formed with this was then cut into strips with a guillotine, the cutting being done across the grooves. The change was made when it was found that the soft sheet could be cut without closing the ends of the grooves. The strips were placed face to back under slight pressure and then cured in an oven for several days. No cement was required, the natural stickiness of the linoleum being sufficient to make a bond between the strips. The pressure required to roll the grooves in the linoleum is so great that the slight pressure required to place the strips in contact is not sufficient to close the holes formed by the grooves. The resulting sheet gave excellent results, in spite of the crudities due to the improvised laboratory apparatus used.

The grooves in the strips were about 0.012 in. wide and deep and were spaced about $\frac{3}{16}$ in. apart. The strips were about $\frac{3}{8}$ in. wide and $\frac{1}{8}$ in. thick. Dimensions of course can be changed to suit requirements. The resulting sheet was $\frac{3}{8}$ in. thick with pores $\frac{3}{16}$ in. apart in rows which are spaced at $\frac{1}{8}$-in. intervals.

One piece was tested as a smoke distributor. Placed in the bottom of a glass-sided flotation cell it gave excellent results. Every hole functioned. The bubbles were small and of the same size, showing even distribution of air and requiring less pressure than the blanket that had been displaced.

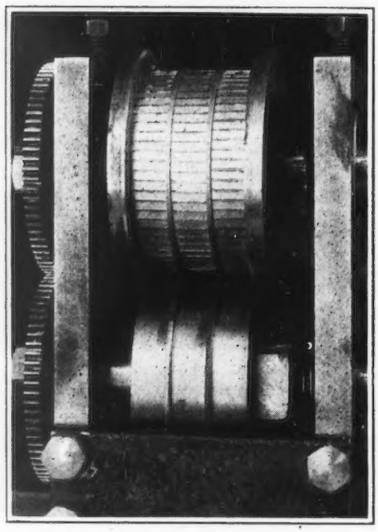


*Fig. 2—Roll first used for impressing grooves in the strips*

Air was blown through a piece of the material into saturated lime water for several days. Lime was deposited on the face of the blanket, but none close to the pores, and not the slighest indication of liming was visible in the tubes. This sheet being non-absorbent to water, the lime-bearing water could not penetrate it to the walls of the tube. The material was therefore free from the troubles experienced with absorbent substances, thus avoiding the necessity of increasing air pressure until a shutdown was required for acid treatment.

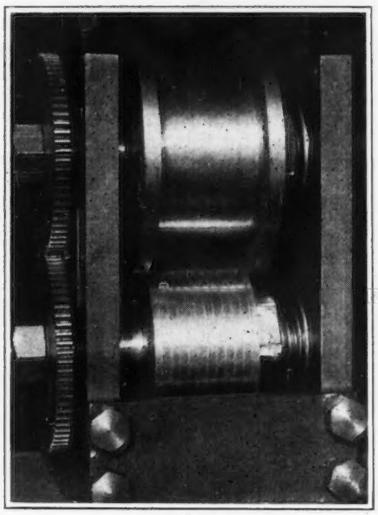
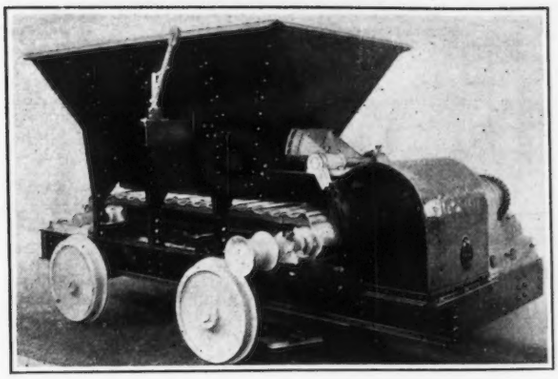


*Fig. 3—Roll finally adopted for grooving the strips*

As stated previously, the material used was made from cork and oils. Cheaper raw material might have been used, such as wood pulp instead of cork, to reduce the cost.

For use as a flotation blanket the material described offers the following advantages over the ordinary woven blanket:

1. It is strong and stiff and lies flat under considerable pressure.
2. Being highly resistant to wear it has a long life and seldom requires repairs.
3. It can be cut, sawed, planed, nailed or glued by any carpenter with ordinary tools. Repairing or patching when necessary is easy.
4. Like other linoleum it is resistant to weak acids and alkali and is not affected by ordinary flotation pulps.
5. It is impervious to and unaffected by water.
6. It does not collect lime in the



*Four of these apron feeders have been designed for service at a Mexican mine*

pores, so that acid treatments are unnecessary.

7. The holes maintain their size and do not lime up, so that increase of air pressure is unnecessary.

8. The air passages being straight and smooth, a minimum of air pressure is required.

9. All the pores function, are of the same size, and are uniformly distributed. Air distribution is therefore uniform.

10. The holes may be of some predetermined size. The bubbles may be small and uniform in size.

### The New Apron Feeder

An ingenious arrangement of an automatic steel apron feeder, 30 in. wide and 7 ft. 6 in. between centers, on a traveling car, is shown in the accompanying photograph. It permits the withdrawal of ore from a bin at different points of discharge with a single equipment. The equipment may be moved along a track extending underneath the entire length of a storage bin.

A large feed hopper introduces the material to the traveling apron and delivery from the apron is regulated by an adjustable quadrant gate. The electric motor which drives it is mounted at one end of the car frame and is completely enclosed within a steel hood. A single trolley collector receives current from an overhead feed wire.

One end of the feeder shaft extends to the side of the car frame to carry a capstan convenient for snubbing a rope for shifting the traveling feeder in either direction.

The total weight of each feeder is about 10,000 lb. Four of them have been designed and built by Stephens-Adamson Manufacturing Company, of Aurora, Ill., to handle lead concentrate at a Mexican property.

## Filter Companies Merge

ANNOUNCEMENT of the organization of Oliver United Filters, Inc., was made during the past week. This was the first public intimation of the merger of the two important interests in the filtration field, namely, the Oliver Continuous Filter Co. and the United Filters Corporation. The address of the new company is 503 Market St., San Francisco. Branches will be maintained in New York, Chicago, Salt Lake City, Montreal, London, Paris, Johannesburg, Melbourne, and other foreign points.

Edwin Letts Oliver, former president of the Oliver Continuous Filter Co., will be president and general manager of the new company. E. J. Sweetland will be chairman of the board. R. Gordon Walker, John T. Hoyt, and William Harold Oliver, will be vice-presidents.

The new company will handle the following products: Oliver continuous filters; American continuous filters; Sweetland pressure filters; Kelly pressure filters; United plate and frame presses; Sweetland cantilever filters; Oliver-Borden thickeners; Sweetland thickeners; Sweetland metallic filter fabric; vacuum pumps; centrifugal pumps, and Olivite acid pumps. Factories will be maintained at Oakland, Calif., and Hazleton, Pa.

The company has requested that until further notice all orders and inquiries for Oliver filter equipment be referred to 33 West 42nd St., New York; and for United Filters, Inc., equipment to 25 Broadway, New York.

## INDUSTRIAL NOTES

Dr. R. P. Heuer is resigning as instructor in chemical engineering at the University of Pennsylvania to become director of research for the General Refractories Company. He will make his headquarters at the general offices of the company in Philadelphia. In addition to directing the company's research laboratories in Baltimore, Dr. Heuer will devote much of his time to field work among refractories users on technical problems related to the company's products.

The appointment of James Cleary as general sales manager of Combustion Engineering Corporation will be of interest to a great many men in the power plant field. Mr. Cleary is well known in this field, having been engaged in engineering and sales work for over twenty-five years. Since associating himself with Combustion Engineering Corporation, in 1921, he has been district manager of the Philadelphia and Detroit offices and for the last two years assistant general sales manager.

A. C. Kingston has been appointed by the Boston Woven Hose & Rubber Company to be assistant general manager in charge of sales and has been elected a member of the board of directors. J. W. Fellows, factory manager, has also been elected a director.

Charles H. Upson, for the last twenty-three years district manager for the Dodge Manufacturing Company, has joined the sales organization of the Chain Belt Company. His headquarters will be at Cincinnati.

The Chicago office of the Smith Engineering Works has just been moved from the Old Colony Building to the Builders Building. This office is in charge of Victor H. Jones, who has served as Chicago district manager for five years.

The Brown Instrument Company, Philadelphia, is building another addition to its plant. The rapid growth of the company and the enlargement of its line has made this necessary. Its primary purpose is to provide adequate research facilities.

Chicago Pneumatic Tool Company, 6 East 44th St., New York, has appointed George J. Lynch as district sales manager at 1931 Washington Ave., St. Louis, Mo. Mr. Lynch was formerly assistant district manager in the New York office.

At a recent meeting of the Chisholm-Moore Hoist Corporation the following directors were named: Julius F. Stone, Julius F. Stone, Jr., J. C. Dunn, A. L. McKinnon, and Frederick Mitchell. Julius F. Stone was elected president; Julius F. Stone, Jr., vice-president; J. C. Dunn, vice-president and treasurer; and Frederick Mitchell, secretary. John R. Mears continues as sales manager.

The Jenison Machinery Company, of 58 Fremont St., San Francisco, successors to the northern California division of the Smith-Booth-Usher Company, has taken over the Stuart S. Smith Company, engineers and machinery merchants. Stuart S. Smith has joined the new organization as manager of the construction equipment division and one of the vice-presidents and directors of the Jenison company.

## PATENTS

Skip-Hoist System. No. 1,671,215. May 29, 1928. William P. Alexander, assignor to R. H. Beaumont Company, Inc., Philadelphia.

Air Filters. No. 1,671,383. May 29, 1928. W. E. Snaman, Pittsburgh, Pa.

Furnace Construction and Operation. No. 1,671,395. May 29, 1928. Dudley Baird, assignor to Nichols Copper Company, New York.

# NEWS OF THE WEEK

## Summary

*PRODUCERS in the Michigan copper district are preparing to adopt the flotation process for the treatment of amygdaloid mineral, as developed by Arthur W. Fahrenwald, of the U. S. Bureau of Mines. The new method is expected to save 2 lb. of copper per ton. Page 28.*

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*Three Grass Valley, Calif., gold mines—the North Star, Empire, and Idaho-Maryland—are doing considerable development work in the hope of offsetting increasing production costs. Page 26.*

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*Lead-zinc output from the Rico Argentine, in the San Juan district, Colo., is being gradually increased. The management expects to be treating 150 tons a day soon. Page 25.*

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*New hydrochloric plant of the Chemical & Metallurgical Corporation at Runcorn, England, is working satisfactorily, according to reports from London. Page 29.*

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*The capacity of the Silver King Coalition mill, at Park City, Utah, has been increased to 1,000 tons daily by the addition of new flotation equipment. Page 27.*

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*The clock and carillon subscribed for by American engineers to commemorate their fellow engineers who died in the World War was presented on July 4 to the University of Louvain, Belgium, for its new library building. Page 27.*

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*Construction of the Verde Central mill at Jerome, Ariz., is being pushed. Night and day shifts are engaged in the work of building the 300-ton concentrator. Page 29.*

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*Metal shipments from Mexico are being reverted to Tampico, and the plan for new port works at Corpus Christi to handle metal traffic has been abandoned, as handlers in the Mexican port have come to terms with the mining companies. Page 28.*

## Refusal to Issue Writ in Silver Case Does Not Conclude Suit

By Paul Wooton
*Special Washington Correspondent*

THE FINDING of the Supreme Court of the District of Columbia that the American Silver Producers' Association, the Della S. Consolidated Mining Company, and the Spar Consolidated Mining Company are not legally qualified to receive a writ of mandamus to compel the Secretary of the Treasury and the Director of the Mint to complete the purchase of the entire amount of silver provided by the Pittman Act is only the first step in the case. Following the action of Justice Stafford, attorneys for the silver interests made known their intention to appeal to the Court of Appeals of the District. The entire case, and not the single issue as to the right of the litigants to enter the suit, will be heard by the Court of Appeals.

In his opinion, Justice Stafford stated that the Silver Association is a mere representative of its members and has no direct financial interest in the purchase of silver, since it is a non-profit corporation. Referring to the claim of the silver interests of injury by failure of the government to purchase this silver, the court says a general averment of injury cannot avail further than it is supported by facts. The opinion declared that the association has no direct financial interest in the performance of the alleged duties of the government officials concerned, and that the two mining companies would not be financially benefited if the writ were issued. "The association does not have any right to maintain this proceeding at law as the mere agent or representative of its members," said Justice Stafford. He points out that it is not clear that these two companies are ready and able to furnish silver to the government, adding that the government would not be required to purchase silver from these companies, as it could get silver from others to satisfy the requirements of the act.

Justice Stafford said further, "A state, without its consent, cannot be sued by an individual. A court cannot substitute its own discretion for that of executive officers in matters belonging to the proper jurisdiction of the latter. When a plain official duty, requiring no exercise of discretion, is to be performed, and performance is refused, any person who will sustain personal injury by such refusal may have a mandamus to compel its performance."

### Ahmeek Nearing Monthly Output of 3,000,000 Lb.

Ahmeek, the big amygdaloid producer of Calumet & Hecla Consolidated, producing from three shafts, is approaching an output of 3,000,000 lb. of refined copper per month. In No. 2 shaft, a small amount of rock is coming from Allouez ground. Ahmeek rock is averaging about 30 lb. to the ton, refined.

### Hollinger Stops Development Work at Kamiskotia

Hollinger Consolidated, of Timmins, Ont., has ceased operations at the properties it holds under option in the Kamiskotia copper district of Ontario. The working crews have been withdrawn, with the exception of a force left to keep the pumps in operation. It has been decided to await further developments on the neighboring properties before proceeding with more extensive operations. The Aconda mine, in the same district, has a crew of 15 to 20 men still at work.

### Tom Reed Crosscut Hits Ore

The crosscut which is being driven at the 800 level of the Tom Reed mine, in the Oatman district of Arizona, has intersected the main vein at a distance of 225 ft. from the shaft. At that point the vein is 18 ft. wide, of which about 8 ft. is milling ore. The crosscut intersects the vein 510 ft. west of the orebody on the 700 level, and 790 ft. west of the spot on the United American property at which the orebody was first discovered. In the meanwhile unwatering operations are proceeding to permit shaft sinking below the 900 level, where a large flow of water was recently struck.

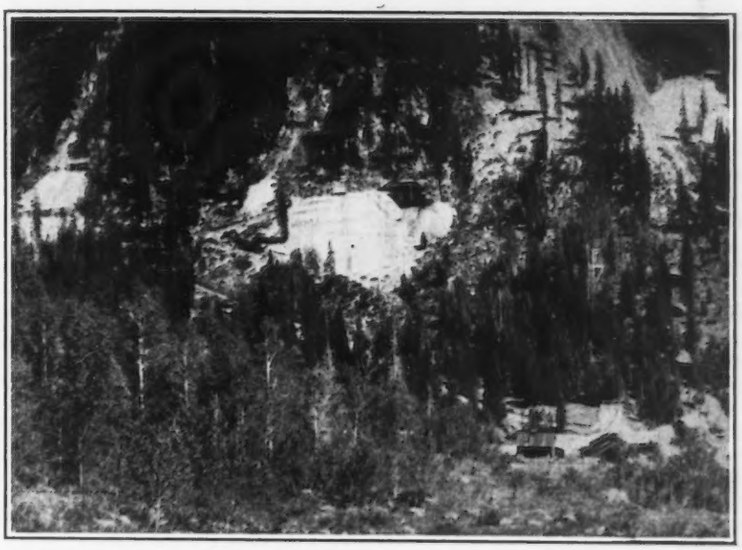
## Lead-Zinc Output Increased at Rico Argentine Mine

SHIPMENTS of lead-zinc ore are being made from the Rico Argentine mine, near Rico, Colo., at the rate of 115 tons a day. It is expected that this output will reach 150 tons daily within the next two months. Development of the lower ore-bearing limestone beds of the property is being pushed for the purpose of increasing production to insure continuous operation of the local milling plant treating the ore.

Operations at the property are effected through three tunnels, namely, the Log Cabin, Argentine, and Blaine. Above the Blaine tunnel level, the lowest of the three, sixteen beds of limestone are found, all of which are considered favorable for ore deposits. Production to date, however, has come from four beds, known as Nos. 1, 2, 3, and 4, that lie between the Argentine and Log Cabin tunnel levels. The Blaine tunnel, which is 255 ft. vertically below the Argentine, is being driven ahead to develop the Zero and No. 1 beds, besides four unnamed beds, between the Argentine and Blaine tunnel levels. Ore in Zero bed is 20 ft. thick and 40 ft. wide; that in bed No. 1 is 25 ft. thick and 60 ft. wide. Beds Nos. 5 to 12 inclusive are above the Log Cabin tunnel level, bed No. 6 being known as the Walsh bed, from which Tom Walsh obtained sufficient revenue to purchase the Camp Bird mine. Development of the ore deposits in these upper beds will be undertaken sometime in the future. Alongside and parallel to the lead-zinc deposits are copper-bearing orebodies of approximately the same size. No shipments of this ore, however, are being made at present, all extraction operations being confined to the lead-zinc deposits.

Two aërial tramways convey the ore from the mine to loading stations, from which it is hauled by trucks to the local mill. The property is equipped with an Ingersoll-Rand compressor capable of operating 15 drills.

Development of the mine into a substantial shipper and dividend payer has been accomplished with practically no publicity, the owners having confidence in the property and proceeding quietly with its development. The property was in litigation for six years prior to 1925, but a settlement was reached in December, 1924, and those now in control commenced operations the next month. Shipments of lead-zinc ore were begun in August, 1925, to the Midvale plant of the U. S. Smelting, Refining & Mining Company. These continued until January, 1926, when the International Smelting Company placed a selective flotation mill in operation at Rico. Shipments were then diverted to the local mill, which has since treated the ore.



*Looking southeast toward the Rico Argentine property. The Log Cabin tunnel is seen at the upper right, Argentine tunnel in the center, and loading station in the foreground.*

## Ophir Hill Consolidated Drifting and Drilling

FOLLOWING a temporary suspension of operations as a result of encountering a heavy flow of water, development is again actively in progress at the property of Ophir Hill Consolidated Mining, situated in Ophir Canyon, 70 miles south of Salt Lake City.

The new workings on the property consist of a 1,400-ft. vertical shaft sunk from the end of a 300-ft. tunnel driven on the west side of the canyon, and east and west drifts from the 1,340 level of the shaft. Water was encountered at a distance of 1,400 ft. in the west drift, and two bulkheads were placed in the drift to dam off the flow of water. Diamond drilling is now being done in the drift between the shaft and the nearest bulkhead, which is 600 ft. from the shaft. Drifting has reached a distance of 1,000 ft. toward the east in the other drift, and this heading is being steadily advanced.

With the water flow in the west drift bulkheaded off, only a 150-gal.-per-minute flow prevails at the property. This is easily handled by the pumping equipment, consisting of a Worthington triplex pump having a capacity of 150 gal. a minute and a four-stage Byron Jackson centrifugal unit rated at 300 gal. a minute. Both pumps are situated on the 1,340 level.

## New Equipment Is Installed at New Idria

NEW IDRIA Quicksilver Mines, which owns quicksilver mines at Idria, Calif., and one of the oldest quicksilver producers in the state, is operating two rotary furnaces out of the four with which the reduction plant is equipped. A new vertical, three-compartment shaft has been extended to the 1,300 level, or 300 ft. below the present adit level. This opens out the property for exploration and mining well below previous stoping operations.

A new electric hoist has been installed and an electric motor-driven triplex pump, automatically contolled, has been placed on the lowest level. Quarrying operations with Insley gas shovels are under way in the outcrop workings. A trommel equipment for screening and hand picking has been also installed.

Overburden is handled by a conveyor system in conjunction with glory holes. The ore zone dips into a steep hillside at from 45 to 55 deg. An adit, 8x8 ft. in cross-section, was extended on the 300 level into the hanging wall and a vertical raise extended 300 ft. to the surface. The hanging-wall material is milled down through the raise and transported to the waste dump on the hillside by a conveyor, 1,100 ft. in length, 42-in. belt. The conveyor is extended as the waste pile builds up. Already more than 1,000,000 tons of overburden has been removed. As the deposit and old workings are exposed, they are mined by the gas shovels and after screening and sorting the ore is sent to the reduction works.

## Johnson Copper Will Sink 200 Ft. Deeper

Retimbering of the main shaft at the property of Johnson Copper Development at Johnson, Cochise County, Ariz., has been completed and preparations for sinking the shaft 200 ft. further have been begun. The machinery on the property has been completely overhauled for the work. It is planned to cut stations at the 350 and 450 levels. Crosscuts to the orebody will be driven on both these levels. The holdings of the company are known as the Climax group, totaling 125 acres in area, and carrying a copper-silver ore.

# Grass Valley Gold Mines Are Pushing Development Programs

*North Star Seeking New Ore to Offset Increasing Production Costs—Empire Mine Can Crush About 300 Tons a Day—Idaho-Maryland Developing 500 Ft. a Month*

IN THE Grass Valley area of California, three important properties are active—the North Star, Empire and Idaho-Maryland. The North Star has a splendid record, admirably displayed in its annual reports, but, since 1924, deficits have occurred, resulting largely from advance development initiated in 1925, which totaled $552,300 over and above normal development, and $200,651 expended on three outside properties, all of which were discarded. In 1924, the mine was almost without developed ore resources, and it became necessary to adopt a new program. This called for sinking the vertical shaft 2,000 ft. to the 3,600 level; sinking two inclines, 3,800 ft. in total length; and 2,500 ft. of levels. This program was almost completed in 1927 and the inclines connected on the 8,600 level. The current year started more favorably, but the advance development did not disclose any great orebody, and, although promising stoping ground was encountered, the stoping areas have been barely sufficient to keep the 60-stamp mill in operation. However, the advance development has made accessible virgin areas, and it is expected that these will be found productive.

Ore is being mined from three veins: the No. 1, which strikes northwest and dips to the northeast; No. 2, which strikes north and dips west; and No. 3, which also strikes north and dips west. About 1,000 ft. of development work per month is the present rate. This work is contracted. Drifting costs vary from $11.88 to $14.19 per foot; raising, $13 to $15 per foot. Explosives amounting to from 11½ to 14½ lb. per foot are required in drifting. Stoping costs are: breaking, 60c.; shoveling, 48c.; sorting, 17c.; timbering and filling, 50c.; or $1.75 per ton. Tramming cost varies, but averages about 17c. per ton. Over-all operating costs, excluding development, were $6.95 per ton crushed in 1927, and an improvement will be made this year.

Drainage equipment at the North Star has been simplified. On the lowest level a 200-g.p.m. three-plunger, horizontal Taylor pump operates half time and pumps from the 8,600 level to the 4,000, or about 2,000 ft.; from the 4,000 to the drain tunnel (1,400-ft. lift), a 550-g.p.m. five-plunger, horizontal Taylor pump operates 14 hours a day. Both pumps are belt-driven by motors. The main working shaft is now vertical to a depth of 3,500 ft. and the hoist is operated for two instead of three shifts as was formerly necessary. Hoisting ropes have an average life of 17 to 18 months, as against three months formerly. Underground Connus blowers are used for auxiliary ventilation. On the lowest levels a Root blower is being installed for forcing air through the long exploration drifts. Mining methods have not been materially changed. Small scrapers are used in the stopes as well as in the raises. A change has been made in the stope car, the back plate being cut down so as to make easier shoveling and to admit placing long stulls in the car. Storage battery locomotives and mules are used underground.

Few changes have taken place in milling and cyanidation. In 1922 the recovery by amalgamation was 82.67 per cent of the total; by cyanidation, 17.33. In 1927 the respective figures were 70.16 and 29.84. Loss in tailings in 1922 was estimated at about 27c. per ton crushed and the loss in 1927 was estimated at 35c. per ton crushed.

It is of interest to note the increase in cost of producing $1 in gold. For the five years beginning with 1912, the average cost was 54c.; for 1922 it was 86½c. and for the five preceding years, 81c. To the end of 1927 the aggregate production since 1884 was 2,813,510 tons yielding $29,805,807 at an operating and development expense of $22,603,711, leaving an operating profit of $7,202,096 or $2.56 per ton. With an efficient plant, experienced operating force and excellent management, the North Star should speedily recover its former position.

At the Empire mine an average of about 60 stamps out of 80 are in operation, and about 300 tons per day is being crushed. A good deal of development is under way, averaging about 1,000 ft. per month. The extent to which this mine has been opened up is evidenced by the fact that several working places are two miles apart on the same level. The 7,000-ft. level is being developed, a vertical depth of nearly 4,000 ft. having been attained. The principal ore supply is from the Empire vein below the 4,600 level. Some ore is being obtained from the Sultana ground.

Comparatively few changes have been made in underground equipment. A new pump station has been placed on the 3,800 level, a Taylor horizontal plunger pump, belt drive, being installed. Storage-battery locomotives are used on the 4,600 level, and mules on all other levels. An underground shaft serves the mine between the 4,600 and the 7,000 levels. As in the North Star, mounted drills are being used in stoping. A concrete change house has been constructed and shaft buildings have been made fireproof.

At the Idaho-Maryland, Superintendent Albert Crase is enthusiastic about possibilities. As may be remembered this property reverted under option to Errol MacBoyle and his associates of San Francisco after Metals Exploration had spent several millions in exploration work and found that it did not suit its purpose. MacBoyle has continued the work. Tributers were first placed in the mine, but these have been reduced to eight. About seventy men are now employed and 500 ft. of development work per month is in progress. A 20-stamp mill is operated on a 3-shift basis, crushing about 65 tons per day. No stoping is done and ore is derived from development operations. The mine is opened to the 2,350-ft. level or about 2,000 ft. vertically. Seven veins are being developed: the Idaho-Maryland on the 1,000 and 1,600 levels; the 180 vein and the Dorsey vein on the 1,600; the 1,950 vein, the 89 vein and the Dorsey footwall vein on the 1,900 level and the Moorehouse vein on the 2,000 and 2,350 levels. The lateral extent of the workings is 4,000 ft. As present work is concentrated upon development, the Idaho-Maryland should soon be in a position to enter upon a production campaign. This will necessitate additional plant and other equipment.

## Assets of Silver King to Be Sold at Auction

THE ASSETS of the once famous Silver King mine, a short distance from Superior, in the Pioneer district, Pinal County, Ariz., will be sold at a Sheriff's sale on July 17, to satisfy a judgment for $6,001.93 obtained by Carl Hoerath for services and money advanced.

Silver King was one of the best known of the early Arizona mines. It is credited with a production of $10,000,000 in silver, gold, and copper, and is known to have paid dividends amounting to $1,950,000 prior to July, 1887. The mine has been opened to a total depth of 1,000 ft. Although originally worked for gold and silver, copper ore was found at about 310 ft. and continued in commercial quantities to the 500 level.

The property was sold under foreclosure to bondholders of the Silver King of Arizona Mining Company, who organized Silver King Mines, with a capital of 1,000,000 shares of $1 par.

## Amity Ships Second Carload

Amity Copper, in the Boston Creek district of Ontario, has made a second shipment of copper ore to the Noranda smelter. Regular shipments from the property are expected soon.

The winze on the 250 level is down 15 ft. with the vein showing evidence of widening. The company estimates that 20,000 tons of ore is blocked out, in addition to ore on the dumps.

## Silver King Coalition Increases Capacity of Mill

NEW FLOTATION equipment placed in operation June 29, at the mill of Silver King Coalition Mines, situated 1½ miles north of Park City, Utah, has enabled the company to increase the capacity of the plant from 600 to 1,000 tons in 24 hours.

Twenty-eight MacIntosh flotation machines, each driven by an individual motor operating through a Foote gear-reduction unit, are now used in treating the silver-lead-zinc ore mined at the property. Twenty of the machines serve as roughers, ten operating in the lead section and ten in the zinc section. Four are employed as lead cleaners, and four as zinc cleaners.

Remodeling of the Silver King mill has been under way during the last four months, and, when completed, about a month hence, a No. 4 Symons cone crusher, in addition to the new flotation equipment, will be included in the flow sheet.

## Cancel Option on United Verde Extension

UNITED Verde Extension will not exchange its properties at Clemenceau, Ariz., for 60,000 shares of Newmont Mining stock, as a result of the opposition on the part of some of its shareholders. Newmont was granted a month's option on the United Verde Ex. properties on June 6, by vote of the directors of the company. The option included mines, mill, and smelter. The plan submitted to the shareholders provided that the shares of Newmont stock would be distributed proportionately. At the time, the valuation of the Newmont stock was given as $175 a share.

Officials of the Newmont company visited the copper mine at Clemenceau last month, and it is probable that Newmont would have exercised its option had not the United Verde Ex. shareholders objected. The expenditures made by Newmont in examining and visiting the property will be paid by United Verde Ex.

## Air Transport for Diamonds in South Africa

Aërial transport of diamonds in South Africa will become a reality if reported plans for the establishment of a regular air service between Alexander Bay and Cape Town are carried out, according to the U. S. Department of Commerce. In addition to the policing of the Namaqualand area, South Africa's latest diamond field, from the air, the feasibility of aërial transportation is being considered, it is understood, by private firms. It has not yet been ascertained when the actual construction of the aërodrome at Alexander Bay will be commenced, but this new development may influence earlier operations.

*Looking southeast across Deer Valley toward the property of Park City Consolidated Mines Company. The Roosevelt group of claims is located on the hills in the foreground, and the St. Louis Ontario and East Ontario on those in the background. The old Daly Judge electrolytic zinc plant is seen in the lower right hand corner.*

## Park City Consolidated Will Develop Unproven Area

SYSTEMATIC development, with the object of determining the productive possibilities at depth in the eastern section of the Park City district of Utah, will be started in about two weeks by Park City Consolidated Mines on a tract of 503 acres that adjoins the property of Park Utah Consolidated on the east and north.

J. J. Beeson, vice-president and consulting geologist of the company, is making a detailed geologic study of the ground, and as soon as this work is completed development will begin. A compressor plant has been purchased, and will be installed at the site of initial operations.

The area controlled by the company is situated three-fourths of a mile east of Park City, and comprises four groups of claims, namely, the Roosevelt group, totaling 140 acres; St. Louis Ontario group of 218 acres; East Ontario group of 60 acres; and the Park City Consolidated group of 85 acres.

Earlier operations in this section have been of a superficial nature, none of the several shafts and tunnels reaching the underlying geologic formations productive in the other portions of the district. According to present plans of the company, a 150-ft. tunnel on the western border of the Roosevelt group of claims, which is now being cleaned out and retimbered, will be extended to a total distance of 300 ft. From this point a shaft will be sunk through the lower measures of the Park City limestone to the Weber or Ontario quartzite; then crosscuts will be driven north and south to the objective mineralized fissures, in which drifts will be started.

Directors and officers of the company are George H. Dern, president; James J. Devine, vice-president and secretary; J. J. Beeson, vice-president and consulting geologist; Charles H. Barton, treasurer; J. D. Stack, Norman N. Blye, J. L. Chadwick, H. M. Rowe, and R. B. Porter.

## Engineers Present Clock to Louvain University Library

ENGINEERING was extolled as the dominating force of the modern world in an address of the War Memorial Committee of American Engineers, formally presenting to the University of Louvain on July 4 a clock and carillon costing $80,000 for the tower of the new Library Building. The ceremony took place in connection with the dedication of the Library.

The address, in French, and signed by all the members of the committee, was handed to the Secretary of the University, Leon Van der Essen, by Dr. Edward Dean Adams, of New York, chairman of the committee and representative of the Engineering Foundation.

Secretary Van der Essen read the address, which recited that "To the glory of God and in memory of their fellow engineers who died in service during the Great War, 1914-1918, engineering societies of the United States of America present to the University of Louvain, the carillon and the clock installed in the tower of the Library of the University, the endowment fund of $10,000 for their maintenance, the Honor Roll of those who died, and a record of the names of all those whose contributions have made this memorial possible."

## Columbia Steel Corporation Buys Burke Iron Holdings

Holdings of the Burke Iron Company, situated at Iron Mountain, Utah, and estimated to contain 15,000,000 tons of ore, have been taken over by the Columbia Steel Corporation, according to an announcement made June 29 by L. F. Rains, vice-president of the corporation. The terms of the purchase were not revealed.

# Expect to Save 2 Lb. of Copper per Ton with Flotation in Michigan District

PRODUCERS in the Michigan copper district are preparing to adopt the flotation process for the treatment of amygdaloid mineral in the stamp mills, as developed by Arthur W. Fahrenwald, of the U. S. Bureau of Mines. The new method will save at least 2 lb. more per ton of rock than is now recovered. On this basis, the saving will be roughly 10,800,000 lb. of copper per year. This estimate is considered conservative by all mining men and metallurgists in the district. The discovery, they state, adds materially to the value of every mining property in the Michigan field.

An experimental plant already is installed in the Ahmeek mill of Calumet & Hecla Consolidated, and similar plants will be put into operation in the other mills in the district. Laboratory experiments have been confirmed by the tests in the Ahmeek mill, and it is the opinion of those informed that the results in actual practice will be even better than in the laboratory tests. A notable reduction in production costs is promised as a result of the new method. Savings will be effected both in concentration and smelting. There will be no table middling to regrind and there will be lower slag losses.

Amygdaloid ore, which constitutes the predominant ore of the district, is at present being milled by straight gravity concentration methods. These methods have been perfected so that only a quarter of 1 per cent, or less, of copper is lost in the tailings. However, the losses are from 4 to 5 lb. of copper per ton, which has been going into the dumps as waste. Attempts have been made in the past to treat amygdaloid mineral by the flotation process, but all have resulted in failure.

In the Michigan district, copper occurs as native copper, in two general classes of formations, amygdaloid and conglomerate. In amygdaloid, the relative coarseness of the metallic copper and the flaky character of the liberated copper after crushing have been heretofore considered as preventing the mineral from being amenable to treatment by the flotation process.

Adaptation of the Fahrenwald flotation method to treatment of amygdaloid mineral is the most important result to date of the research program instituted by Dr. W. O. Hotchkiss, president of the Michigan College of Mining and Technology at Houghton. He has enlisted the co-operation of the U. S. Bureau of Mines, the state geological survey, the mining companies and other agencies. Michigan this year appropriated $25,000 for research work. The appropriation for copper research available for the fiscal year beginning July 1 is $50,000.

Commenting on the flotation process as applied to amygdaloid mineral, C. H. Benedict, chief metallurgist for Calumet & Hecla Consolidated, said he considered the stated saving of 2 lb. per ton as very conservative. Similar expressions were made by others interested in the new method.

## Suit Against Century Zinc Settled Out of Court

W. N. SMITH, general manager of Century Zinc; S. H. Davis, manager of the Joplin-Miami properties of the company; the Century Zinc Company, and the Vinegar Hill Zinc Company have settled out of court a suit brought against them by Lilla Mishler and children, former owners of the ground on which the Century's Malsbury mine is situated. The defendants have agreed to pay $70,000 in settlement of claims against them. Suit was filed in the Ottawa County, Okla., district court, and the complaint charged that the lease to the 40-acre tract was illegal.

The original suit also named Charles A. Malsbury and others as defendants and asked from all a sum amounting to $300,000. Settlement by Smith and Davis does not affect the suit as it relates to Malsbury and associates. In the stipulation under which the $70,000 was paid, it was set forth that the companies and Smith and Davis acquired the leases from Malsbury in full payment of their value, with no knowledge that they did not hold a good and lawful title to the lease.

## Lead Blast-Furnace Practice To Be Investigated

IN co-operation with the smelting companies in the Salt Lake Valley, the Intermountain Station of the U. S. Bureau of Mines on July 1 began an investigation of lead blast-furnace practice with the intention of determining how the efficiency of such operations may be increased. This investigation by the Bureau has been encouraged as a result of the valuable information obtained in the course of a similar study of iron blast-furnace practice made by E. P. Royster, T. L. Joseph, and S. P. Kinney, of the Bureau, at the Minneapolis station.

G. L. Oldright, supervising metallurgist of the non-ferrous branch of the Bureau, will direct the investigation of lead blast-furnace practice. Virgil Miller, assistant metallurgist, on the staff of the Intermountain Station, will be in active charge of the work, most of which will be done at the plants of the smelting companies operating in the district. Smelting companies co-operating in the investigation include International Smelting; American Smelting & Refining; and U. S. Smelting, Refining & Mining.

## Agreement Reached by Mining Companies and Handlers at Tampico

AN AGREEMENT has been reached between the shippers and handlers of ores and metals at Tampico which will cause an abandonment of plans for diverting all such shipments to Corpus Christi, Tex., and Galveston. Mining and smelting companies contended that the charges for handling shipments at Tampico were excessive, and during the last few months, pending settlement of the controversy, a considerable part of these exports was diverted to Texas ports.

Figures of the customs authorities show that exports of ores and minerals through the port of Tampico in May amounted to 38,475 tons, divided as follows: Zinc concentrates, 19,851 tons; zinc calcines, 5,911; lead in bars, 10,607; copper, 1,637; antimony, 173; and arsenic, 295 tons.

From January to April 30, mineral exports totaled 135,356 tons, of which concentrates of zinc amounted to 69,322 tons; zinc calcines, 10,515; zinc ingots, 610; lead in bars, 47,996; copper, 5,472; antimony, 400; and arsenic, 1,042 tons.

## All-Steel Mill Being Built in Tri-State District

St. Louis Smelting & Refining has started construction of an all-steel mill on its Ballard lease, west of Baxter Springs, Kan., in the Tri-State district. Charles Schwarz, of St. Louis, was in the district last week and placed his approval on the final plans of the concentrator as planned by L. W. Ledyard, district superintendent. The St. Louis company is controlled by National Lead.

The Hartley-Grantham mill of the Century Zinc Company, near Baxter Springs, Kan., in the Tri-State district, has been placed in operation. The mill was completed several months ago, but because of the curtailment program in effect in the district, it was not started on completion.

## Reopening Mohawk Mine, in Pinal County, Ariz.

Work of reopening the old Mohawk mine, at Schultz, near Mammoth, Ariz., is being done by the St. Anthony Mining & Development Company, which recently bought the property. The Mohawk carries gold, vanadium, and molybdenum ores, and is credited with a production of about $6,000,000.

A new compressor has been installed and other machinery has been ordered. United Verde examined the mine last year. The St. Anthony company owns the adjoining Mammoth and Collins groups, which are equipped with a 200-ton concentrator and flotation plant. These mines have been inactive since 1923.

# London Letter

By W. A. Doman
*Special Correspondent*

## New Acid Plants of Chem. & Met. Corporation Working Satisfactorily

London, June 19, 1928.—The hydrochloric acid plant of the Chemical & Metallurgical Corporation, at Runcorn, has been working for five or six weeks and is giving every satisfaction. At the same place, the sulphuric acid plant was started about ten days ago, and, according to report, is "going splendidly." The process for treating platinum ores is expected to be put into operation in about a fortnight's time, and the lead plant is timed to start up at the end of August. At the works, slab zinc is being produced from Fresnillo ore and also from ores from Broken Hill and Lake George (Australia).

Discussions are now taking place between the government and the Nitrate Producers' Association with a view to devising some selling scheme which will preclude the recurrence of the cut-throat competition in consuming markets between consigning producers and importers that has been the feature during the last few months. The continually falling prices and losses which have resulted have disgusted many of those interested in distribution.

I mentioned last week the formation of the African Asbestos Trust, with a large property and an important tonnage of fiber proved. It had been hoped to start dealings in the shares yesterday, but for some reason, not quite understood, the Stock Exchange committee has, I am informed, postponed consideration of the question for another fortnight. In one quarter a remark was made that, as there were already African asbestos companies' shares actively dealt in on the London market, others were not wanted, but this remark did not apply to the committee of the Stock Exchange, who are impartial and naturally like to see active business brought to the "House."

DOUBTLESS because demand for asbestos and its price have risen of late, other companies for working it are being formed. The Abbaye Development Company, Ltd., has obtained firm options to purchase a number of asbestos properties in South Africa, one of which is in a diamondiferous area. The notice of the company states that there is a world shortage of asbestos "and the price of this commodity at the moment is extremely interesting and likely to improve."

A fortnight ago I referred to the formation of a company called the Consolidated Tin Mines of Burma. This company has now appeared before the public with a capital of £1,000,000 in £1 shares. It is not itself appealing for funds, but 350,000 of its shares are being offered through the Burmese Mines Agency, Ltd., at par. The company is to acquire and work seventeen tin mines, all of which are producing. Twelve of the properties are contiguous and form a block 9 miles long by approximately 2 miles wide. They comprise what is recognized to be the richest mineralized tin zone in Burma, from which are derived the alluvial deposits of several of the well known Burmese tin dredging companies. The intersting point about the Consolidated Tin Mines of Burma is that tin is obtained from two sources—the sluicing of decomposed granite during the wet season, say four months of the year, and from the innumerable veins which constitute the lode system and make the property one of the most fascinating in the East.

## New Verde Central Mill to Start Operations in October

A TRIAL run of the new Verde Central mill, now under construction, is expected by Oct. 1, according to a statement credited to R. H. Dickson, manager of the property, located in the Jerome district of Arizona.

More than 50 men are engaged in the construction work, and operations are being continued 24 hours a day, with the night shift consisting of 12 men. More than half the necessary excavating has been completed and forms are being placed for the foundations. The road from the shaft to the head of the mill has been cut and is being used for the haulage of material. The narrow track will not be laid until the mill is nearing completion and ready to handle ore.

## Two Big Cottonwood Mines Under New Control

KENTUCKY-UTAH Mining Company was recently organized at Salt Lake City to take over the merged interests of Big Cottonwood Coalition Mines and Woodlawn Copper Mining, that include 900 acres situated in Big Cottonwood Canyon and three miles west of Brighton, Utah.

Operations through the 6,000-ft. tunnel on the Big Cottonwood Coalition property were scheduled to start by Kentucky-Utah about July 1, following the transfer of equipment now at the Woodlawn mine to the Big Cottonwood property.

According to present plans, the Big Cottonwood tunnel will be extended 3,000 ft., with the object of encountering extensions of silver-lead-zinc orebodies developed 740 ft. above the tunnel level on the Woodlawn property.

Officers and directors of the new company are: E. J. Jeremy, president; G. N. Lawrence, vice-president; M. C. Morris, secretary-treasurer; A. P. Spitko, W. C. Hurd, W. G. Romney, and B. Nebeker.

# Mexico City Letter

By W. L. Vail
*Special Correspondent*

## Interest in Taviche District of Oaxaca Revived by Plan for New Smelter

Mexico City, June 24, 1928.—Reports that Arthur Battes, of Los Angeles, proposes to invest about 3,000,000 pesos in acquiring large mining holdings in the State of Oaxaca, mostly in the Taviche district, and in constructing a custom smelter, have revived interest in that section of the state. Mr. Battes has been examining the situation there for several weeks. Reports from other camps in the state indicate that mining is normal.

In the annual report of the United Eastern Mining Company, recently issued, some interesting references are made to the experiments on tailings in the Guanajuato camp. John Arlington devised a system of treatment for these tailings, which carry gold, silver, copper, and mercury, and a 300-ton mill was erected. Operations started on April 26, 1928, and though some mechanical difficulties have developed, they are being eliminated. It is expected that a profit of about $1.50 a ton will be made on the 500,000 tons of tailings which it is estimated remain on the dumps.

AT THE Butters Copala property of the company, in Sinaloa, a shaft was sunk to explore the Tajito vein below the lowest workings. The vein was encountered at a depth of 200 ft. Drifting was started on this level. At a distance of 257 ft. ore of commercial grade was encountered, and has been developed for an additional length of 110 ft. It is thought probable that this oreshoot may have a total length of 400 or 500 ft. The average width of the vein is 4 ft. It carries both gold and silver.

## Democrats Adopt Plank on Mining Similar to That of Republicans

AT THE Democratic convention at Houston, Tex., on June 28, the following plank was adopted in regard to the mining industries:

"Mining is one of the basic industries of the country. We produce more coal, iron, and copper than any other country. The value of our mineral production is second only to agriculture. Mining has suffered like agriculture and from similar causes. It is the duty of our government to foster the industry and to remove the restrictions that destroy its prosperity."

Editorial comment on the platforms of the two principal political parties in regard to mining industries may be found on page 3.

# Societies, Addresses, Reports

## McGraw-Hill and Shaw Companies Merge

*Consolidation Affects Twenty Engineering and Industrial Papers and "Magazine of Business," "System," and "Industrial Distributor and Salesman"*

A CONSOLIDATION affecting two large publishing interests has recently been brought about by the merger of the McGraw-Hill Publishing Company, Inc., of New York, and the A. W. Shaw Company, of Chicago.

The Shaw organization publishes *The Magazine of Business, System* and *Industrial Distributor and Salesman,* while the McGraw-Hill organization is the publisher, either directly or through subsidiary and affiliated companies, of over twenty leading business papers, and of engineering and business books. Its magazines cover the electrical, mechanical, construction, mining and chemical fields, and include such well-known papers as *Electrical World, Engineering News-Record, Power, American Machinist, Engineering & Mining Journal, Chemical & Metallurgical Engineering* and *Radio Retailing.* The two companies have had a close relationship since last fall, when they jointly formed the McGraw-Shaw Company, which publishes *Factory and Industrial Management* and *Industrial Engineering.*

Mr. A. W. Shaw will continue as chairman of the board and Mr. James H. McGraw will become president of the A. W. Shaw Company. Mr. Shaw will also become a director of the McGraw-Hill Publishing Company, Inc., and will continue as president of the McGraw-Shaw Company. Mr. Wheeler Sammons will become a director and member of the executive committee of the McGraw-Hill Publishing Company and senior vice-president and general manager of the A. W. Shaw division of the business, which will be known as the "A. W. Shaw Company, a division of the McGraw-Hill Publishing Company, Inc." The McGraw-Shaw Company will also be operated as a division of the McGraw-Hill Publishing Company.

Two reasons for the merger are stressed by the officers of the merging companies. The magazines of the two organizations are complementary in character. The Shaw papers cover business broadly, giving the business man an understanding of what is going on in all branches of trade, industry and finance. Their service is extensive in character. The McGraw-Hill service, on the other hand, is intensive. Its magazines give a highly specialized service to given major industries and to related industrial groups. Thus the consolidated companies serve the business man in both his general and special business interests. The second reason is the very evident economy and increased effectiveness of consolidated operation, enabling a superior service to be rendered to the whole sweep of American business.

Mr. Shaw, who is now in New York, made this comment on the consolidation:

"It is gratifying to me after long years spent in developing the Shaw publications to have them put together with the strong group developed under Mr. McGraw's leadership. The combination will strengthen both groups. *The Magazine of Business* and *System* cover broadly the problems of all business, and exchange knowledge between its different divisions. The McGraw-Hill papers specialize on the problems of a dozen or more major branches of industry and trade. The advantages of joint control of these related but differing publications is apparent.

"The merger comes at a particularly gratifying time, when the Shaw organization, following a plan long contemplated, is re-establishing *System,* which was the pioneer general business paper. For more than twenty-five years it was the guide, philosopher and friend of tens of thousands of men conducting the smaller businesses of this country and the administrative work of the larger ones. To this well-discharged task it now returns—and fortunately at a time when the McGraw-Hill and Shaw merger enables a maximum of energy to be put back of the inspiring task of re-establishment."

Mr. McGraw gave the following reasons for the merger:

"Mr. Shaw's organization and ours have been working closely together for more than a year, and have seen the benefits of consolidated effort between groups having widely different publishing experiences. The Shaw company has had a signal success in publishing magazines of large circulation and of broad appeal to the industrial and business worlds. The McGraw-Hill company has intensively served by specialized publications, the leading engineering industries and the trade channels for distributing their products.

"It was apparent that the McGraw-Hill group of industrial and trade papers would have a new way of carrying the message of common business problems if it was allied with papers like *The Magazine of Business* and *System.* At the same time these publications would be immeasurably strengthened by being tied in with and assisted by the great editorial staff of over one hundred and thirty industrial and business specialists who edit the McGraw-Hill papers. There were also conspicuous opportunities for more effective subscription and advertising work and for economies in every phase of publishing.

"The logic of these opportunities could not be escaped. The merger has been the result.

"Though every paper of the merging companies will be strengthened by the consolidation, and thus render greater service to its readers and advertisers, the most conspicuous result will be the new and strong position of *The Magazine of Business.* Through Mr. Shaw's vision and courage it is a magazine of strength, standing and influence. It now becomes the capstone of the virile group of papers and the other publishing activities of the McGraw-Hill company, thus extending the scope of the latter organization to the whole range of American business. At the same time, drawing on the intimate contact with trade and industry of the large corps of McGraw-Hill specialist editors, it will speak with unexampled authority on the problems of business. It will be able to render an outstanding service to the business men of America by its authoritative information, its expert interpretation, and its fearless advocacy of sound business policies. It will fight for the interests of business, but it will place in an equally important position, the responsibility of business to the public. It will, in a word, stand for true business statesmanship."

## Fundamental Data Important in Geophysical Prospecting

PHYSICAL characteristics of ore-bodies, and of the minerals composing them, are important factors in the application of geophysical methods of prospecting, according to results obtained in the course of investigations made during the first six months of this year under a co-operative agreement between the Department of Mining and Metallurgical Research of the University of Utah and the Radiore Company of Los Angeles.

Laboratory tests by the department indicate that the physical characteristics sought are best revealed by a combination of microscopic, chemical, and electrical methods of study. Facilities for such studies are available at the Intermountain Station of the U. S. Bureau of Mines, situated at Salt Lake City, with which station the Department of Mining and Metallurgical Research of the University of Utah is co-operating. The facilities at the station were, therefore, utilized in making the investigations. R. M. Anderson, research engineer of the Radiore Company, represented that company in the work, and R. E. Head, microscopist of the Intermountain Station of the Bureau, supervised the microscopic studies.

As a result of this co-operative work by the Department of Mining and Metallurgical Research, the data obtained will be available to the U. S. Bureau of Mines for investigations relating to geophysical prospecting.

# BOOK REVIEWS

## Causes of International Mistrust and Suspicion

SOUTH AMERICA LOOKS AT THE UNITED STATES. By C. H. Haring. New York: The Macmillan Company. Price $2.50.

ANY SERIOUS study of the underlying causes of international friction is worthy of attention, and Professor Haring had made a significant contribution to a subject that needs airing. The survey, including residence and travel in South America in 1925-26, was made under the auspices of the Bureau of International Research of Harvard University and Radcliffe College. The outcome—the book under review—is scholarly and readable. It should pave the way to a better understanding of national prejudices and idiosyncracies, and result in some improvement in international relations.

The title may mislead: The book is largely historical—necessarily so. Development of the economic sway of the United States to the south—inevitable and irresistible—is outlined, not neglecting the indirect result of the Hay-Pauncefote treaty of 1901. The changing scope of the Monroe Doctrine deserves and receives due attention, because in some quarters it is considered "but a camouflage for the political and economic hegemony of the United States." Before attempting to discuss the sources of international mistrust, Professor Haring makes a thorough study of economical and industrial conditions in the various South American countries.

Says the author, "Distrust of the United States among the people of Latin America in the past has been for the most part a political distrust, engendered by episodes in the diplomatic history of the western hemisphere, increased by the extraordinary growth of the United States in population, wealth, and political prestige, fostered by European rivals who would like to see the preponderant influence of the great northern republic displaced by that of certain kindred transatlantic peoples. . . ." The latter factor is of considerable importance. The United States, in its relations with a South American country, must break down the barriers of mistrust and suspicion engendered by a domestic political propaganda against the "Colossus of the North"; but, more important than this, it must recognize and take some steps to counteract a clever and insidious propaganda that never ceases—the undermining of confidence and the planting of suspicion in the minds of South Americans that the United States is inferior in ethics, culture, and morals to the leading European nations.

The United States is inclined to be too boastful of its industrial penetration of South America. As Professor Haring points out: ". . . British capital interested in the railways of Argentina alone nearly equals the entire American investment in the southern continent." He also bravely "grasps the nettle" in drawing attention to a subject that is indirectly the cause of much international ill-feeling and misunderstanding—the filling of posts in South America with United States citizens that represent mediocrity in attainment and experience, and narrowness of outlook. Europe is more careful; but, as Professor Haring points out, "It is extraordinary what our countrymen and countrywomen will do when freed from the restraint of the home town. Either the reservoir of innate vulgarity in the provincial middle classes of the United States is much greater than in the same class in Latin countries, or the latter rarely obtain the means to travel abroad and impose their shortcomings on the suffering foreigner. Middle-class Britishers and Germans are perhaps no better than Americans, but they, too, travel less. They have neither the resources nor the leisure to swarm on those winter cruises around South America made possible by the wide diffusion of wealth in the United States." Dreadful examples are cited to prove how gestures of friendliness to travelers in South America have been so crudely acknowledged as to create dislike and contempt for American citizens in general. In Professor Haring's opinion, the behavior of so large a proportion is adequate "to explain the charge of vulgarity made against a whole nation," and the criticisms "complicate immensely the task of creating goodwill relations between North and South America."

A. W. A.

EMPLOYEES' STOCK PURCHASE PLANS. National Industrial Conference Board, 247 Park Ave., New York; 245 pp. Price $2.50.

THIS volume is the result of an investigation, conducted by Margaret L. Stecker, under the supervision of the Economic Council of the National Industrial Conference Board, of the movement in the United States toward increased holding by workers of securities of the corporations by which they are employed. The investigation was based on data secured from 389 companies.

The first chapter of the book describes various plans whereby employees may secure the individual and exclusive ownership of stock, bonds, or other securities by cash purchase or on some form of part payment. The plans, for the most part, conform to one of two types, represented by (1) subscription for a certain number of shares of stock, or (2) payment of a certain amount at specified intervals into a fund from which stock is purchased. It also treats of the extent of employee stock ownership in the United States in 1927.

Features of various stock-purchase plans are next considered in detail under such headings as "Motives for offering securities to employees," "Classes of securities sold," "Classes of securities offered," "Average ability of employees to buy," "Limitations on number of securities to be purchased," and "Terms of purchase."

Various problems in connection with the operation of stock-purchase plans are discussed. It is pointed out that whereas some companies urge in no uncertain terms that their employees become stockholders, others are careful to see that no employee is under obligation to purchase stock. The cancellation of subscriptions and resale of securities are two problems that have received considerable attention, and the various methods used for discouraging them are presented.

The benefits to the company and to the employee of such stock sales are discussed. Under benefits to the company, increased favorable publicity, decreased labor turnover, increased interest and loyalty, increased thrift, and means of obtaining new capital are mentioned. Under the advantages that accrue to the employee are listed the ease and high yield on the investment, participation in management, and, in a few cases, such advantages as participation in profit-sharing plans not open to non-stockholding employees. As a disadvantage, the risk of the investment is pointed out, as well as the means taken by some companies of avoiding this disadvantage. Three appendices are included with the book. The first describes in detail the stock-purchase plans of six large corporations; the second is a list of companies which had or have had stock acquisition plans for their employees, and the third is a story of some stock subscriptions.

MINING PRACTICE, SOUTH AFRICA—The issues of the *South African Mining and Engineering Journal* of March 31, April 7, and April 14 contain a series of articles describing mining practices on the Rand. The first of these, in the March 31 issue, is entitled "Mechanical Lashing." It describes a method for transferring broken ore down long flat stopes from the point where it is broken to that where it is loaded for haulage to the shaft. This method appears to have been first used at the Modder B, and, according to the writer, is also used at the Witwatersrand Gold Mines. It consists in stretching two parallel cables down and parallel with the dip of the stope between two upright supports at the top and two similar supports at the bottom, on which cables, as a track, a tray is allowed to run under gravity with proper buffers at the bottom to arrest its motion, thereby discharging the ore which has been loaded into it by hand at the upper end of the stope. The remaining two issues describe various other mining methods and their modifications in use at some of the mines. Among the subjects dealt with are: control of hanging; ventilation; waste control; and labor economy.

# Personal Notes

ADOLPH KNOPF, of the geological department of Yale University, is in California.

B. F. TILLSON, assistant superintendent of New Jersey Zinc, is now at Lake Oliver, Ind.

R. G. KNICKERBOCKER, metallurgist in Spain for Rio Tinto, has returned to the United States.

JOHN MARTIN, of the Corner House staff, and Mrs. Martin left Johannesburg recently on a visit to England.

KARL BERNSON, of the Salt Lake City office of General Engineering, sailed for London from New York on July 6.

GEORGE D. VAN ARSDALE was in New York for several days recently. He returned to Los Angeles on July 3.

H. R. PLATE is now in Burlingame, Calif., not Burlington, as was erroneously stated in *Engineering and Mining Journal* of June 16.

B. E. CHARLES, mining engineer with the Compañia Minera de la Cienega, operating in Chihuahua, Mexico, is now at 416 Charles St., Salina, Kan.

C. E. WOODS is in charge of work at the Pyramid mine, near Shingle Springs, Placer County, Calif., which is being reopened by J. G. CHAMBERS.

THOMPSON H. MURCH, Western sales manager for Colonial Steel, has returned to his Salt Lake City headquarters after several weeks in Los Angeles and San Francisco on business.

WILLIAM ANTHONY, until recently connected with the Majestic Mining Company at Totolapam, Oaxaca, Mexico, is now mill superintendent for Minerva Mining at Asientos, Aguascalientes.

H. L. GLENN, mining engineer, of Columbus, Ohio, arrived in Sydney, Australia, recently, to investigate the mining industries of Australia and New Zealand on behalf of the Jeffrey Manufacturing Company.

J. H. STOVEL, who recently resigned as manager of Central Manitoba Mines, has been appointed superintendent of the Dome Mines, in the Porcupine area of northern Ontario. He succeeds C. W. DOWSETT, who resigned last fall.

MONTGOMERY R. BUDD, director of publications at the Colorado School of Mines, has resigned. He left Golden, Colo., on June 28 for Schenectady, N. Y., where he has accepted a position with the publicity department of General Electric.

ROBERT E. TALLY, general manager for United Verde Copper, has been made a member of the advisory board of the Institute of Municipal Administration, which will meet this summer at the University of Southern California, Los Angeles, on Aug. 13.

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WILLIAM D. JOHNSTON, JR., who recently resigned his post as assistant professor of geology at the New Mexico School of Mines, Socorro, N. M., has accepted a position with the ground-

W. D. JOHNSTON, JR.

water division of the U. S. Geological Survey, effective July 1. Mr. Johnston also resigned from the New Mexico State Bureau of Mines and Mineral Resources, with which he was associated as geologist.

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W. B. A. DINGWALL, late manager of the Santa Maria mines of La Paz, Matehuala, S. L. P., Mexico, recently returned there from Mexico City, where he underwent a successful operation for cataract, which had been responsible for his blindness during the last five years.

ARTHUR L. CRAWFORD has been added to the staff undertaking microscopic work for the department of mining and metallurgical research of the University of Utah. Mr. Crawford was formerly a member of the geological faculty at the University of Wyoming.

BROUGHTON EDGE, who has been appointed to control the application of geophysical prospecting methods in Australia during the next two years, reached Melbourne in May. The survey, which will cost about £32,000, is being carried out under an agreement between the Australian federal government and the British Empire Marketing Board.

J. H. HUNT, mill superintendent for the Teziutlan Copper Company, Teziutlan, Puebla, Mexico, has recovered from injuries received at the time of the mine fire at the mine. Mr. Hunt descended three times into the burning mine, in which 26 men lost their lives, in an effort to save miners left below. The fire started on March 9, and raged for more than two weeks.

EDWARD H. DENNY, district mining engineer of the U. S. Bureau of Mines, stationed at Denver, Colo., arrived in Salt Lake City on June 26 to confer with members of the State of Utah Industrial Commission on the possibility of flows of strata gas into the workings of certain mines in the district. Mr. Denny made a study last year of the rock-strata gases in the Cripple Creek mining district of Colorado.

## OBITUARY

It is with deep regret that we announce the death of Mrs. JOHN V. N. DORR, which occurred July 3 in New York City.

PERCY COPELAND, of the Anglo-French Exploration Company, which is a holding company owning stock in mining companies in South Africa, Canada, Burma, and elsewhere, died recently at Johannesburg.

GEORGE S. BAXTER, engineer and contractor of New York City, died in that city on July 2. Mr. Baxter was 83 years old. He was a graduate of Williams College in 1865 and received his engineering degree at Columbia in 1868. He was engaged in mining engineering from that time until 1879 when he became interested in railroad construction.

GEORGE H. V. BELYEA, JR., mining engineer, met his death by drowning at Narrow Lake, in the Patricia district of northern Ontario, on June 22. He was 26 years old, and a recent graduate of the University of Toronto. At the time he was engaged as mining engineer in charge of operations at the property of the Narrow Lake Mining Company, Ltd. Mr. Belyea was a native of St. John, N. B., and was unmarried.

JAMES WOOD, at one time superintendent of the Calumet & Arizona smelter, and credited with being the man who placed in operation the first Bessemer converter in the old Copper Queen plant, died suddenly at his home at Santa Monica, Calif., on June 20. Heart disease, from which he had been a mild sufferer for many years, was the direct cause of death. Mr. Wood was 70 years old. When the first Copper Queen smelter was built in Bisbee, Mr. Wood, who was then in Butte, was asked to direct the operations, and he placed in operation the first Bessemer furnace in the old smelter which was on the hill behind the Bisbee post office. Later, he went to Douglas, as superintendent for the Calumet & Arizona smelter, where he remained for many years. Mr. Wood is survived by a widow, two daughters and five sons.

# MARKET AND FINANCIAL NEWS

## Domestic Refining of Platinum Group Metals Decreased During 1927

PLATINUM refiners of the United States in 1927 purchased 236 oz. of crude placer platinum of domestic origin and 48,907 oz. of foreign crude platinum, according to J. M. Hill, of the U. S. Bureau of Mines. In 1926, the refiners purchased 171 oz. of domestic crude platinum and 43,096 oz. of foreign crude platinum. Domestic material purchased in 1927 included 10 oz. from Alaska, 189 oz. from California, and 37 oz. from Oregon. Purchases of foreign crude platinum in 1927 were: Australia 1,390 oz., Canada 19 oz., Colombia 43,557 oz., Russia 17 oz., and South Africa 3,924 oz.

Refined platinum metals recovered in 1927 from crude platinum, from ore and concentrates, and from gold and copper refining amounted to 46,050 oz., of which 8,173 oz. is believed to have come from domestic materials.

Quotations[1] on platinum on Jan. 1, 1927, were $112 an ounce, but the market was declining. By May 9 the price had reached $86 and by June 1 it was $72, which was maintained to the end of the year. The open market price for large lots was nearly uniform at $6 an ounce under the quoted price. Refiners reported the high price for platinum at $110, the low at $75, and the average for the year as $84 an ounce.

Palladium quotations were $63 to $66 an ounce on Jan. 1, 1927, but declined to $55 to $60 by the third week in January, rose to $58 to $62 the first of February, at which level they remained until the middle of March. Prices then advanced to $59 to $63, but sagged again to $53 to $57 the first week of May, and to $52 to $54 by the middle of July, continuing a slow decline until the low of the year was reached, $50 to $52 an ounce, the second week in December. Refiners report a high of $72, a low of $50, and average price for the year as $58 an ounce.

Iridium opened the year at $120 to $125 an ounce, but also declined to $115 to $120 late in January, and $105 to $110 the middle of May. There was a slight recovery in price in June and July, but it did not go above $112 an ounce and sagged to $105 to $108 an ounce in October. In November quotations stood at $110 to $115 an ounce and continued at that figure to the end of the year. Refiners give the following prices: High, $400; low, $105; and average for the year, $120 an ounce.

Rhodium quotations varied from a high of $65 to $75 an ounce at the first of the year to a low of $50 to $52 an ounce at the end of October, but for most of the year the price was $55 an ounce.

Osmium started the year at $65 to $70 an ounce, but dropped to $55 to $60 in the middle of January and recovered to $60 to $65 an ounce in July, at which price it closed the year.

At the end of 1927, stocks of platinum metals in the hands of refiners were 102,056 oz., a decrease of 3 per cent as compared with stocks at the end of 1926.

[1] *Engineering and Mining Journal*, vols. 123 and 124, 1927.

**New Platinum Metals Recovered by Refiners in the United States, 1922-1927, in Troy Ounces**

| Year | Platinum | Palladium | Iridium | Osmiridium | Others | Total |
|---|---|---|---|---|---|---|
| 1922 | 54,142 | 1,943 | 210 | 1,301 | 122 | 57,718 |
| 1923 | 46,780 | 1,934 | 280 | 787 | 16 | 49,797 |
| 1924 | 57,827 | 6,065 | 680 | 1,261 | 174 | 66,007 |
| 1925 | 41,300 | 7,358 | 283 | 648 | 54 | 49,643 |
| 1926 | 76,154 | 6,437 | 234 | 2,113 | 43 | 84,981 |
| 1927 | 41,121 | 3,879 | 256 | 631 | 163 | 46,050 |

**New Platinum Metals Recovered by Refiners in the United States, 1926-1927, by Sources, in Troy Ounces**

| Year | Platinum | Palladium | Iridium | Osmiridium | Others | Total |
|---|---|---|---|---|---|---|
| 1926 | | | | | | |
| Domestic: | | | | | | |
| Crude platinum | 96 | 1 | 23 | 13 | 7 | 140 |
| Ore | ..... | 3,330 | ... | ..... | .. | 3,330 |
| Gold and copper refining | 4,827 | 2,856 | 3 | ..... | 9 | 7,695 |
| | 4,923 | 6,187 | 26 | 13 | 16 | 11,165 |
| Foreign: | | | | | | |
| Crude platinum | 32,668 | 250 | 208 | 2,100 | 27 | 35,253 |
| Gold and copper refining | 38,563 | ..... | ... | ..... | .. | 38,563 |
| | 71,231 | 250 | 208 | 2,100 | 27 | 73,816 |
| Total recovery | 76,154 | 6,437 | 234 | 2,113 | 43 | 84,981 |
| 1927 | | | | | | |
| Domestic: | | | | | | |
| Crude platinum | 84 | 1 | 46 | 30 | 3 | 164 |
| Ore | ..... | 108 | ... | ..... | .. | 108 |
| Gold and copper refining | 4,365 | 3,528 | ... | ..... | 8 | 7,901 |
| | 4,449 | 3,637 | 46 | 30 | 11 | 8,173 |
| Foreign: | | | | | | |
| Crude platinum | 36,672 | 242 | 210 | 601 | 152 | 37,877 |
| Total recovery | 41,121 | 3,879 | 256 | 631 | 163 | 46,050 |

**Platinum Metals Consumed in the United States as Reported by Refiners, 1926 and 1927, by Industries, in Troy Ounces**

| Industry | Platinum | Palladium | Iridium | Others | Tota | Percentage of Total |
|---|---|---|---|---|---|---|
| 1926 | | | | | | |
| Chemical | 10,253 | 213 | 145 | 228 | 10,839 | 6 |
| Electrical | 16,765 | 3,508 | 1,608 | 185 | 22,066 | 13 |
| Dental | 8,542 | 11 063 | 131 | ..... | 19,736 | 11 |
| Jewelry | 85,908 | 7,770 | 2,949 | 454 | 97,081 | 57 |
| Misce laneous | 17,381 | 2,181 | 581 | 1,751 | 21,894 | 13 |
| | 138,849 | 24,735 | 5,414 | 2,618 | 171,616 | 100 |
| 1927 | | | | | | |
| Chemical | 11,010 | 180 | 101 | 175 | 11,466 | 8 |
| Electrical | 14,905 | 2,491 | 1,618 | 121 | 19,135 | 13 |
| Dental | 7,504 | 12,194 | 153 | ..... | 19,851 | 13 |
| Jewelry | 86,036 | 3,706 | 4,059 | 329 | 94,130 | 63 |
| Miscellaneous | 3,176 | 312 | 305 | 1,311 | 5,104 | 3 |
| | 122,631 | 18,883 | 6,236 | 1,936 | 14?,686 | 100 |

**Stocks of Platinum Metals in the Hands of Refiners in the United States, Dec. 31, 1923-1927, in Troy Ounces**

| Year | Platinum | Palladium | Iridium | Others | Total |
|---|---|---|---|---|---|
| 1923 | 36,554 | 26,266 | 5,208 | 2,697 | 70,725 |
| 1924 | 40,464 | 27,400 | 3,622 | 3,053 | 74,539 |
| 1925 | 44,024 | 26,740 | 3,720 | 4,609 | 79,093 |
| 1926 | 64,203 | 31,950 | 3,933 | 5,485 | 105,571 |
| 1927 | 68,757 | 24,313 | 4,617 | 4,369 | 102,056 |

UTAH COPPER COMPANY produced 55,604,174 lb. of copper in the first quarter of 1928. Net income after depreciation was $4,516,220, which compares with $4,212,735 in the fourth quarter of 1927. The average grade of ore treated at the Magna and Arthur plants was 0.96 per cent copper.

HECLA MINING COMPANY reports net profit of $364,535 in the first quarter of 1928, as compared with $374,522 in the last quarter of 1927. Ore production increased from 72,764 tons in the preceding quarter to 80,183 tons in the quarter ending March 31, 1928. Development work at the Union mine in British Columbia continues and the company has appropriated $50,000 to further its exploration work on this property.

# STATISTICAL NOTES

## United States Production of Gold and Silver in 1927

THE Bureau of the Mint, with the co-operation of the Bureau of Mines, has issued the following statement of the final estimate of refinery production of gold and silver in the United States during the calendar year 1927:

| States | Ounces Gold | Ounces Silver |
|---|---|---|
| Alaska | 286,298 | 606,129 |
| Arizona | 203,088 | 6,601,467 |
| California | 564,981 | 1,557,812 |
| Colorado | 259,111 | 3,941,351 |
| Georgia | 15 | 4 |
| Idaho | 15,209 | 8,928,619 |
| Illinois | ..... | 1,500 |
| Michigan | ..... | 51,742 |
| Missouri | ..... | 87,218 |
| Montana | 56,076 | 11,809,765 |
| Nevada | 149,445 | 5,372,900 |
| New Mexico | 26,098 | 754,878 |
| North Carolina | 34 | 134 |
| Oregon | 14,425 | 41,673 |
| Pennsylvania | 126 | 2,299 |
| South Dakota | 322,681 | 95,123 |
| Tennessee | 426 | 82,275 |
| Texas | 324 | 942,971 |
| Utah | 199,518 | 19,353,758 |
| Vermont | ..... | 938 |
| Washington | 19,398 | 161,643 |
| Philippine Islands | 79,872 | 40,242 |
| Totals | 2 197,125 | 60,434,441 |

The reduction in the output of gold and silver as compared with the prior year was, for gold, $2,851,000, and for silver, 2,284,305 oz. In 1915, the year of largest domestic production, gold totaled $101,035,700, and silver 74,961,075 oz.

CASTLE TRETHEWAY MINES, LTD., reports net profit for the year ending March 31, 1928, of $112,466, before depreciation and depletion. There was produced during the fiscal year 858,044 oz. of fine silver and 34,388 lb. of cobalt. Total operating costs per ton of ore milled amounted to $9.616. The tonnage milled was 40,250.

NEGOCIACION MINERA DE SAN RAFAEL Y ANEXAS, S. A., reports net profits of $703,127 in 1927, as compared with $29,777 in 1926. Dividends totaling $880,000 were distributed in 1927.

BURMA CORPORATION, LTD., operating the Burma mine in India, reports for the quarter ending March 31, 1928, the extraction of 109,403 tons of ore from which the following shipments were made:

| | Tons | Average Grade—Silver, Ounces | Per Cent—Lead | Per Cent—Zinc | Per Cent—Copper |
|---|---|---|---|---|---|
| Concentrating ore to mill | 87,051 | 20.4 | 22.3 | 17.4 | 0.4 |
| High-grade ore to smelter | 8,783 | 29.2 | 37.3 | 14.7 | 0.3 |
| Total lead ore | 95,834 | 21.2 | 23.7 | 17.2 | 0.4 |
| Copper ore to smelter | 13,081 | 18.8 | 14.8 | 8.2 | 5.8 |
| Grand total | 108,915 | 20.9 | 22.6 | 16.1 | 1.1 |

The refinery produced 18,424 tons of refined lead and 1,772,878 oz. refined silver. The tonnage of copper matte produced was 3,090 tons, assaying 73.6 oz. of silver, 33.8 per cent lead, and 40.1 per cent copper from the treatment of accumulated smelter byproducts and 16,553 tons of copper ore. In addition to the foregoing, 306 tons of refined antimonial lead was produced.

**Estimated Revenue and Expend ture**

| | |
|---|---|
| Estimated gross revenue | £851,835 |
| Estimated operating expenditure | 550,125 |
| Estimated surplus over working expenditure | £301,710 |
| Estimated income tax and super tax | £49,995 |
| Estimated depreciation on machinery and plant | 59,625 |
| Capital expenditure | £21 856 |

On the No. 9 Level—Plat-cutting at the Marmion shaft was continued, progress being slow because of the "running ground" condition encountered. On the No. 8 Level—east crosscut 48 north intersected the Shan lode, exposing a width of 47¼ ft. of ore assaying 15.9 oz. silver, 21.1 per cent lead, 11.8 per cent zinc, and 1.4 per cent copper. The mining of an increased proportion of ore within the fire area of the Chinaman orebody was maintained.

TRANSVAAL GOLD MINES produced 825,901 oz. of gold in April, 1928, which compares with 877,380 oz. in March, 1928, and 824,014 oz. in April, 1927.

## Imports and Exports of Ores and Metals in May, 1927 and 1928

Compiled from U. S. Department of Commerce Records

*In Pounds, Unless Otherwise Stated*

### Imports

| | May 1927 | May 1928 |
|---|---|---|
| Antimony | | |
| Ore { Gross weight | 690,593 | 279,995 |
| Ore { Antimony content | 393,194 | 131,982 |
| Liquated regulus or metal | 2,675,019 | 1,730,212 |
| Copper | | |
| Ores, copper content | 9,787,046 | 12,242,013 |
| Concentrates, copper content | 3,951,598 | 3,997,053 |
| Regulus, coarse metal, cement copper | 129,374 | 330,646 |
| Imported from: | | |
| Spain | 391,036 | 251,298 |
| Canada | 4,787,695 | 5,336,334 |
| Mexico | 1,840,662 | 4,293,572 |
| Cuba | 2,190,000 | 747,023 |
| Chile | 4,376,707 | 5,672,700 |
| Peru | 107,803 | 106,598 |
| Other countries | 174,115 | 162,187 |
| Unrefined black, blister, converter copper in pigs, bars and other forms | 45,524,638 | 27,868,026 |
| Refined copper | 7,077,623 | 3,272,133 |
| Old and clippings for remanufacture | 493,344 | 434,055 |
| Composition metal, copper chief value | 5,010 | ..... |
| Brass, old, for remanufacture | 867,691 | 896,542 |
| Lead | | |
| Ore and matte, lead content | 7,994,131 | 3,628,624 |
| Bullion or base bullion | 5,701,596 | 21,192,811 |
| Pigs and bars | 734,130 | 58,404 |
| Babbitt, solder and other forms, lead content | 63,920 | 59,305 |
| Type metal, antimonial lead { Gross weight | 44,286 | 223,988 |
| Type metal, antimonial lead { Lead content | 36,315 | 171,720 |
| Manganese, tons | | |
| Cuba, manganese content | 117 | 166 |
| Other countries, manganese content | 18,196 | 16,283 |
| Pyrites, tons | 14,545 | 33,161 |
| Tin | | |
| Ore, tons | 18 | 7 |
| Bars, blocks, pigs | 13,505,385 | 15,781,538 |
| Imported from: | | |
| Netherlands | 1,077,427 | 1,457,130 |
| United Kingdom | 3,303,165 | 3,281,222 |
| British Malaya | 7,566,916 | 8,186,254 |
| Netherland East Indies | 342,150 | 56,000 |
| Hongkong | 621,766 | 179,375 |
| Australia | 100,800 | 134,400 |
| Other countries | 493,161 | 2,487,157 |
| Zinc | | |
| Ore, zinc content { Free, less than 10% zinc | ..... | 50,050 |
| Ore, zinc content { Dutiable | 2,298,002 | 205,700 |
| Blocks, pigs and old | 14,503 | 4,502 |

### Exports

| | May 1927 | May 1928 |
|---|---|---|
| Copper | | |
| Ores, composition, concentrates, unrefined | 1,517,581 | 15,154 |
| Refined copper in ingots and other forms | 66,260 231 | 99,794,638 |
| Exported to: | | |
| Belgium | 8,582,678 | 9,657,791 |
| France | 5,730,918 | 20,442,789 |
| Germany | 16 631,393 | 17,519,553 |
| Italy | 9,785,120 | 9,662,010 |
| Netherlands | 8,577,794 | 7,573,882 |
| Spain | 223,753 | 593,912 |
| Sweden | 1,093,772 | 2,684,461 |
| United Kingdom | 10,865,898 | 15,693,576 |
| Other Europe | 56,033 | 7,595,174 |
| Canada | 1,910,015 | 1,880,755 |
| British India | ..... | 515,433 |
| China, Hongkong, Kwantung | 405,078 | 1,097,600 |
| Japan | 2,172,413 | 4,534,812 |
| Other countries | 225,366 | 342,890 |
| Old and scrap | 4,580,852 | 4,789,445 |
| Pipes and tubes | 245,564 | 371,962 |
| Plates and sheets | 264,887 | 829,498 |
| Rods | 4,303,570 | 6,365,295 |
| Insulated copper wire and cable | 3,399,768 | 1,951,150 |
| Lead | | |
| In pigs, bars and other forms: | | |
| From domestic ore | 692,783 | 1,588,268 |
| From foreign ore | 15,157,182 | 14,720,119 |
| Exported to: | | |
| France | 896,172 | 392,092 |
| Germany | 5,254,259 | 3,607,593 |
| Netherlands | 134,486 | 840,173 |
| Sweden | 403,424 | 918,712 |
| United Kingdom | 4,817,950 | 6,162,137 |
| Other Europe | 313,755 | 505,141 |
| Brazil | 448,100 | 235,299 |
| Other South America | 4,685 | 247,770 |
| China, Hongkong, Kwantung | 560,322 | 224,316 |
| Japan | 2,767,777 | 3,081,169 |
| Other countries | 249,035 | 93,985 |
| Other lead manufactures | 460,441 | 1,407,177 |
| Zinc | | |
| Ores and concentrates, tons | 6,450 | 11 |
| Dross | 454,668 | 698,040 |
| Cast in slabs, blocks and pigs | 3,819,862 | 4,296,391 |
| Exported to: | | |
| Belgium | 56,000 | ..... |
| France | 224,129 | 448,197 |
| Germany | 56,043 | 399,075 |
| Italy | ..... | 615,940 |
| Netherlands | 101,234 | 199,923 |
| United Kingdom | 2,022,555 | 110,741 |
| Other Europe | ..... | 618,303 |
| Argentina | 56,008 | ..... |
| Japan | 1,119,771 | 1,735,387 |
| Other countries | 184,122 | 168,825 |
| Sheets, strips, other forms | 677,904 | 601,767 |
| Dust | 178,617 | 311,826 |
| Other zinc manufactures | 164,487 | 49,578 |

# Metal Statistics

## Monthly Average Prices of Metals

### Silver

| | New York | | London Spot | | Sterling Exchange | |
|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| January | 55.795 | 57.135 | 25.863 | 26.313 | 484.775 | 487.098 |
| February | 57.898 | 57.016 | 26.854 | 26.205 | 484.551 | 487.008 |
| March | 55.306 | 57.245 | 25.655 | 26.329 | 484.887 | 487.558 |
| April | 56.399 | 57.395 | 26.136 | 26.409 | 485.178 | 487.785 |
| May | 56.280 | 60.298 | 26.072 | 27.654 | 485.288 | 487.685 |
| June | 56.769 | 60.019 | 26.203 | 27.459 | 485.183 | 487.565 |
| July | 56.360 | ..... | 25.983 | ..... | 485.145 | ..... |
| August | 54.718 | ..... | 25.224 | ..... | 485.546 | ..... |
| September | 55.445 | ..... | 25.565 | ..... | 485.878 | ..... |
| October | 56.035 | ..... | 25.776 | ..... | 486.533 | ..... |
| November | 57.474 | ..... | 26.526 | ..... | 486.956 | ..... |
| December | 57.957 | ..... | 26.701 | ..... | 487.714 | ..... |
| Year | 56.370 | ..... | 26.047 | ..... | 485.636 | ..... |

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

### Copper

| | New York Electrolytic | | London Spot Standard | | London Spot Electrolytic | |
|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| January | 12.990 | 13.854 | 55.414 | 61.912 | 62.375 | 66.575 |
| February | 12.682 | 13.823 | 54.438 | 61.670 | 61.119 | 66.381 |
| March | 13.079 | 13.845 | 55.935 | 61.148 | 62.641 | 66.443 |
| April | 12.808 | 13.986 | 55.056 | 61.678 | 61.526 | 66.500 |
| May | 12.621 | 14.203 | 54.563 | 62.554 | 60.881 | 67.216 |
| June | 12.370 | 14.527 | 54.030 | 63.664 | 59.881 | 68 738 |
| July | 12.532 | ..... | 54.551 | ..... | 60.089 | ..... |
| August | 12.971 | ..... | 55.364 | ..... | 62.227 | ..... |
| September | 12.940 | ..... | 54.455 | ..... | 61.830 | ..... |
| October | 12.958 | ..... | 55.119 | ..... | 62.256 | ..... |
| November | 13.319 | ..... | 58.830 | ..... | 63.761 | ..... |
| December | 13.774 | ..... | 60.078 | ..... | 66.181 | ..... |
| Year | 12.920 | ..... | 55.653 | ..... | 62.064 | ..... |

New York quotations, cents per pound. London, pounds sterling per long ton.

### Lead

| | New York | | St. Louis | | London | | | |
|---|---|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 Spot | 1927 3 Mos. | 1928 Spot | 1928 3 Mos. |
| January | 7.577 | 6.500 | 7.392 | 6.280 | 27.485 | 27.786 | 21.773 | 22.213 |
| February | 7.420 | 6.329 | 7.286 | 6.069 | 27.344 | 27.781 | 20.283 | 20.747 |
| March | 7.577 | 6.000 | 7.328 | 5.805 | 27.845 | 28.302 | 19.938 | 20.352 |
| April | 7.126 | 6.100 | 6.807 | 5.991 | 26.546 | 27.053 | 20.306 | 20.563 |
| May | 6.616 | 6.123 | 6.269 | 6.012 | 25.054 | 25.526 | 20.483 | 20.813 |
| June | 6.414 | 6.300 | 6.150 | 6.152 | 24.438 | 24.750 | 20.985 | 21.211 |
| July | 6.344 | ..... | 6.120 | ..... | 23.491 | 23.932 | ..... | ..... |
| August | 6.681 | ..... | 6.367 | ..... | 23.119 | 23.540 | ..... | ..... |
| September | 6.297 | ..... | 6.044 | ..... | 21.446 | 21.994 | ..... | ..... |
| October | 6.250 | ..... | 6.013 | ..... | 20.479 | 20.946 | ..... | ..... |
| November | 6.259 | ..... | 6.035 | ..... | 20.889 | 21.318 | ..... | ..... |
| December | 6.504 | ..... | 6.319 | ..... | 22.163 | 22.441 | ..... | ..... |
| Year | 6.755 | ..... | 6.511 | ..... | 24.192 | 24.614 | ..... | ..... |

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

### Tin

| | New York | | London | |
|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 |
| | 99% | | Straits | |
| | | | Spot | |
| January | 64.785 | 55.180 | 66.415 | 55.650 | 297.804 | 253.222 |
| February | 66.528 | 51.793 | 69.142 | 52.440 | 306.125 | 233.833 |
| March | 67.833 | 51.630 | 69.199 | 52.220 | 313.315 | 232.722 |
| April | 66.069 | ..... | 67.933 | 52.270 | 302.572 | 234.204 |
| May | 63.935 | ..... | 67.510 | 51.582 | 294.938 | 230.886 |
| June | 64.226 | ..... | 67.466 | 47.938 | 296.006 | 217.280 |
| July | 62.625 | ..... | 64.110 | ..... | 288.690 | ..... |
| August | 63.523 | ..... | 64.431 | ..... | 293.193 | ..... |
| September | 60.735 | ..... | 61.490 | ..... | 280.432 | ..... |
| October | 57.560 | ..... | 58.450 | ..... | 264.631 | ..... |
| November | 57.089 | ..... | 57.641 | ..... | 262.591 | ..... |
| December | 58.053 | ..... | 58.452 | ..... | 267.138 | ..... |
| Year | 62.747 | ..... | 64.353 | ..... | 288.953 | ..... |

New York quotations, cents per pound. Quotations on 99 per cent tin discontinued on April 1, because of absence of business. London, pounds sterling per long ton.

### Zinc

| | St. Louis | | London | | | |
|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 Spot | 1927 3 Mos. | 1928 Spot | 1928 3 Mos. |
| January | 6.661 | 5.643 | 30.979 | 30.938 | 26.125 | 26.051 |
| February | 6.673 | 5.551 | 29.931 | 30.109 | 25.518 | 25.506 |
| March | 6.692 | 5.624 | 30.649 | 30.889 | 25.082 | 24.960 |
| April | 6.338 | 5.759 | 29.579 | 29.901 | 25.493 | 25.316 |
| May | 6.075 | 6.026 | 29.034 | 29.131 | 26.102 | 25.756 |
| June | 6.213 | 6.158 | 28.598 | 28.613 | 25.664 | 25.429 |
| July | 6.229 | ..... | 28.280 | 28.021 | ..... | ..... |
| August | 6.342 | ..... | 28.210 | 28.068 | ..... | ..... |
| September | 6.212 | ..... | 27.347 | 27.327 | ..... | ..... |
| October | 5.996 | ..... | 26.899 | 26.634 | ..... | ..... |
| November | 5.745 | ..... | 26.281 | 26.006 | ..... | ..... |
| December | 5.722 | ..... | 26.363 | 26.109 | ..... | ..... |
| Year | 6.242 | ..... | 28.513 | 28.479 | ..... | ..... |

St. Louis quotations, cents per pound. London pounds sterling per long ton

## Antimony, Quicksilver and Platinum

| | Antimony (a) New York | | Quicksilver (b) New York | | Platinum (c) Refined New York | | Platinum (c) Crude New York | |
|---|---|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| Jan. | 13.910 | 10.863 | 101.200 | 123.620 | 109.520 | 79.280 | 99.820 | 69.280 |
| Feb. | 14.509 | 10.842 | 101.727 | 121.370 | 107.545 | 84.783 | 99.295 | 74.783 |
| March | 12.801 | 10.083 | 110.259 | 122.557 | 108.000 | 80.000 | 100.426 | 70.000 |
| April | 14.166 | 9.865 | 123.250 | 123.740 | 101.885 | 80.000 | 91.865 | 70.000 |
| May | 12.975 | 11.019 | 123.900 | 123.173 | 84.680 | 78.000 | 75.000 | 68.000 |
| June | 12.447 | 9.750 | 118.096 | 122.423 | 72.000 | 78.000 | 62.500 | 68.000 |
| July | 11.880 | ..... | 119.880 | ..... | 72.000 | ..... | 61.520 | ..... |
| Aug | 11.826 | ..... | 119.111 | ..... | 72.000 | ..... | 62.000 | ..... |
| Sept. | 11.073 | ..... | 119.640 | ..... | 72.000 | ..... | 62.000 | ..... |
| Oct. | 11.165 | ..... | 126.200 | ..... | 72.000 | ..... | 62.000 | ..... |
| Nov. | 10.763 | ..... | 127.708 | ..... | 72.000 | ..... | 62.000 | ..... |
| Dec. | 11.195 | ..... | 126.933 | ..... | 72.000 | ..... | 62.000 | ..... |
| Year | 12.393 | ..... | 118.159 | ..... | 84.636 | ..... | 75.036 | ..... |

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

## Pig Iron, Pittsburgh, and Aluminum 98 Per Cent

| | Bessemer | | Basic | | No. 2 Foundry | | Aluminum | |
|---|---|---|---|---|---|---|---|---|
| | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 | 1927 | 1928 |
| Jan. | 19.50 | 17.50 | 18.16 | 17.00 | 18.50 | 17.25 | 26.270 | 24.300 |
| Feb. | 19.02 | 17.50 | 18.00 | 17.00 | 18.50 | 17.25 | 26.000 | 24.300 |
| March | 19.37 | 17.50 | 18.28 | 17.00 | 18.50 | 17.25 | 26.000 | 24.300 |
| April | 19.50 | 17.50 | 19.00 | 17.00 | 18.50 | 17.24 | 26.000 | 24.300 |
| May | 19.24 | 17.37 | 18.24 | 16.38 | 18.50 | 16.79 | 26.000 | 24.300 |
| June | 18.96 | 17.00 | 17.96 | 15.56 | 18.35 | ..... | 26.000 | 24.300 |
| July | 18.50 | ..... | 17.50 | ..... | 18.00 | ..... | 26.000 | ..... |
| Aug | 18.50 | ..... | 17.32 | ..... | 17.65 | ..... | 26.000 | ..... |
| Sept. | 18.00 | ..... | 17.11 | ..... | 17.50 | ..... | 26.000 | ..... |
| Oct. | 18.00 | ..... | 17.00 | ..... | 17.50 | ..... | 25.600 | ..... |
| Nov. | 18.00 | ..... | 17.00 | ..... | 17.47 | ..... | 25.000 | ..... |
| Dec. | 17.69 | ..... | 17.00 | ..... | 17.25 | ..... | 24.785 | ..... |
| Year | 18.69 | ..... | 17.71 | ..... | 18.02 | ..... | 25.808 | ..... |

Iron in dollars per long ton. Aluminum in cents per pound, 98 per cent grade.

New figures, pig iron f.o.b. Mahoning and Shenango valley furnaces, instead of delivered Pittsburgh. Difference from former figures, which were delivered Pittsburgh, $1.76, this being the freight.

## Monthly Crude Copper Output in Short Tons

**Domestic**

| | 1927 | | 1928 | | | |
|---|---|---|---|---|---|---|
| | Dec. | Jan. | Feb. | Mar. | April | May |
| Alaska shipments | 1,655 | 2,084 | 908 | 3,495 | 2,084 | 1,767 |
| Butte & Superior | †238 | ..... | ..... | †205 | ..... | ..... |
| Calumet & Arizona | 2,065 | 2,066 | 2,041 | 2,019 | 2,102 | 2,726 |
| Magma | 652 | 1,300 | 1,398 | 1,346 | 1,525 | 1,451 |
| Miami | 2,032 | 1,963 | 1,955 | 2,029 | 2,092 | 2,185 |
| New Cornelia | 3,607 | 3,672 | 3,267 | 3,318 | 3,224 | 2,924 |
| Nevada Con | †26,253 | ..... | ..... | †26,288 | ..... | ..... |
| Old Dominion | 801 | *996 | *992 | *1,009 | *988 | *1,010 |
| Phelps Dodge†† | 7,757 | 8,273 | 7,331 | 7,803 | 8,334 | 8,083 |
| United Verde Extension | 1,930 | 1,633 | 1,624 | 1,699 | 1,604 | 1,724 |
| Utah Copper | †27,810 | ..... | ..... | †27,810 | ..... | ..... |
| Tennessee Copper | 617 | 510 | 514 | 596 | 526 | 582 |

**Foreign**

| | | | | | | |
|---|---|---|---|---|---|---|
| Braden | 9,348 | 8,502 | 8,504 | 8,504 | ..... | ..... |
| Boleo, Mexico | 1,001 | 1,068 | 1,262 | 1,130 | 1,012 | 953 |
| Bwana M'Kubwa | 554 | 677 | 600 | 533 | 392 | 556 |
| Chile | 8,972 | 8,146 | 8,119 | 7,854 | ..... | ..... |
| Furukawa, Japan | 1,563 | 1,548 | 1,563 | ..... | ..... | ..... |
| Granby Cons., Canada | 1,936 | 2,305 | 2,155 | 2,326 | 2,406 | 2,505 |
| Mount Lyell, Australia | †2,064 | ..... | ..... | †1,510 | ..... | ..... |
| Sumitomo, Japan | 1,412 | 1,317 | 1,381 | 1,316 | 1,483 | 1,475 |
| Union Miniere, Africa | 10,780 | 10,359 | 9,590 | 10,689 | 10,780 | 10,689 |

†Three months. *Includes Arizona Commercial
††Moctezuma is included.

## Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

| | 1926 | | 1927 | | 1928 | |
|---|---|---|---|---|---|---|
| | Monthly Production | Daily Rate | Monthly Production | Daily Rate | Monthly Production | Daily Rate |
| January | 71,026 | 2,291 | 76,198 | 2,458 | 68,469 | 2,209 |
| February | 68,131 | 2,433 | 69,202 | 2,472 | 67,423 | 2,325 |
| March | 75,728 | 2,443 | 69,314 | 2,236 | 70,327 | 2,269 |
| April | 73,454 | 2,448 | 71,122 | 2,371 | 69,230 | 2,308 |
| May | 73,542 | 2,372 | 71,613 | 2,310 | 73,279 | 2,378 |
| June | 71,317 | 2,377 | 69,539 | 2,318 | ..... | ..... |
| July | 72,228 | 2,330 | 65,545 | 2,114 | ..... | ..... |
| August | 72,014 | 2,323 | 67,248 | 2,169 | ..... | ..... |
| September | 72,672 | 2,421 | 65,936 | 2,198 | ..... | ..... |
| October | 75,099 | 2,423 | 68,595 | 2,225 | ..... | ..... |
| November | 74,947 | 2,498 | 68,080 | 2,269 | ..... | ..... |
| December | 72,205 | 2,329 | 67,377 | 2,173 | ..... | ..... |
| Total | 872,509 | ..... | 829,878 | ..... | 349,669 | ..... |
| Monthly average | 72,709 | ..... | 69,165 | ..... | 69,934 | ..... |
| Average of daily rate | ..... | 2,390 | ..... | 2,274 | ..... | 2,300 |

# The Market Report

## Metal Markets Lapse Into Holiday Quiet

*New York, July 3, 1928*—With Independence Day coming tomorrow, and summer vacations in order, the metal markets have quieted down considerably. Sales of all the more important metals were, for the week under review, well below the normal weekly average. Prices have not been affected adversely, however, silver being the only metal to be quotably lower than a week ago, the decline in that metal being three-quarters of a cent.

### Copper Demand Largely for Prompt

Almost three-quarters of the copper sold this week was for July shipment, but it must not be inferred from this that there is any great amount of prompt metal available or that demand for early shipment is acute. The tonnage sold has been the lowest for more than two months, few buyers other than those who have found themselves a little short of current requirements having been in the market. Prices are unchanged, at 14¾c. for Eastern deliveries and 14⅞c. at nearby Middle Western points. Foreign demand has also been quiet, at 15c., c.i.f., though a little more activity was reported today.

### Lead Marks Time

Monday, July 2, was a fairly good day so far as sales of lead were concerned, but business on the other days has been slim indeed. Prices are quotably unchanged, although second-hands are understood to have been offering limited tonnages at 6.125c. in the St. Louis market. The American Smelting & Refining Company has continued its contract price in New York at 6.30c., and other sellers have realized this figure. The leading sellers in the Middle West have been firm at 6.15c., and some business was done, especially on Monday. Buying of desilverized lead in the Chicago district at the New York price also is reported. Deliveries in June were good, and most observers look for a small decline in stocks when the statistics are available. Production is still at a comparatively modest rate, and the position in the domestic market is much the same as it has been for more than a month. Looking back over the quotations for the last three years, it is seen that July in each instance has been marked by a sharp advance in prices. Whether history will repeat itself in July, 1928, is a question to which both buyers and sellers would like an answer. London has shown a small decline for the week, particularly for forward metal. However, this is probably accounted for by the readjustment of the position at the end of the month.

### Average Metal Prices for June, 1928

| | |
|---|---|
| COPPER: | |
| New York Electrolytic | 14.527 |
| London Standard Spot | 63.664 |
| London Electrolytic Spot | 68.738 |
| LEAD: | |
| New York | 6.30 |
| St. Louis | 6.152 |
| London Spot | 20.985 |
| London Forward | 21.211 |
| SILVER: | |
| New York | 60.019 |
| London | 27.459 |
| Sterling Exchange | 487.565 |
| ZINC: | |
| St. Louis | 6.158 |
| London Spot | 25.664 |
| London Forward | 25.429 |
| TIN: | |
| Straits | 47.938 |
| London | 217.280 |
| QUICKSILVER | 122.423 |
| ANTIMONY | 9.750 |
| PLATINUM: | |
| Refined | 78.000 |
| Crude | 68.000 |
| ALUMINUM 99 PER CENT PLUS. | 24.300 |

### Daily Prices of Metals

| June / July | Electrolytic Copper | Straits Tin | Lead | | Zinc |
|---|---|---|---|---|---|
| | Refinery | New York | New York | St. Louis | St. Louis |
| 28 | 14.525 | 47.125 | 6.30 | 6.15 | 6.20 |
| 29 | 14.525 | 47.25 | 6.30 | 6.15 | 6.20 |
| 30 | 14.525 | 47.25 | 6.30 | 6.15 | 6.20 |
| 2 | 14.525 | 46.125 | 6.30 | 6.15 | 6.175@6.20 |
| 3 | 14.525 | 46.00@46.25 | 6.30 | 6.15 | 6.20 |
| 4 | Holiday | ..... | .... | .... | ..... |
| | 14.525 | 46.775 | 6.300 | 6.150 | 6.198 |

Average prices for calendar week ending June 30, 1928, are: Copper, 14.525; Straits tin, 46.854; N. Y. lead, 6.300; St. Louis lead, 6.150; zinc, 6.183; and silver, 59.917.

**The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.**

**Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.**

**In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.**

**Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.**

**Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.**

**Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.**

### London

| June / July | Copper | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard | | Electrolytic | Spot | 3M | Spot | 3M | Spot | 3M |
| | Spot | 3M | | | | | | | |
| 28 | 63 1/16 | 63 | 68½ | 213¾ | 210½ | 20⅞ | 20 15/16 | 25 11/16 | 25 7/16 |
| 29 | 63⅛ | 63¼ | 68½ | 213½ | 210½ | 20⅝ | 20⅞ | 25 9/16 | 25⅜ |
| 2 | 63 3/16 | 63 3/16 | 68½ | 211¾ | 208⅜ | 20 9/16 | 20⅞ | 25⅜ | 25 5/16 |
| 3 | 63 | 63⅛ | 68½ | 205½ | 203½ | 20 7/16 | 20¾ | 25 5/16 | 25 5/16 |
| 4 | 63¼ | 63 3/16 | 68½ | 206⅝ | 204⅝ | 20 9/16 | 20⅞ | 25 7/16 | 20¼ |

**The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb**

### Silver, Gold, and Sterling Exchange

| June | Sterling Exchange "Checks" | Silver | | Gold London | July | Sterling Exchange "Checks" | Silver | | Gold London |
|---|---|---|---|---|---|---|---|---|---|
| | | New York | London | | | | New York | London | |
| 28 | 4.87⅛ | 59¼ | 27 7/16 | 84s10½d | 2 | 4.87 | 59⅝ | 27 7/16 | 84s10 3/4d |
| 29 | 4.87⅛ | 59⅜ | 27⅜ | 84s10½d | 3 | 4.86¾ | 59⅜ | 27⅜ | 84s10d |
| 30 | 4.87 | 59⅝ | 27 7/16 | ..... | 4 | ..... | ... | 27 5/16 | 84s10½d |
| | | | | | | Avg. | 59.650 | | |

**New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.**

## Zinc Slightly Stronger

Zinc, like copper, has not been active, though sales have been well above those of a month ago. Most of the business has been done with galvanizers, and the price has ruled at 6.20c., St. Louis, all week, for July shipment, though one round lot marketed yesterday brought only 6.175c., buyers being apathetic. For August shipment, 6¼c. is generally quoted, but scarcely any has been sold. High-grade prices are nominally about a cent above Prime Western, though demand is almost entirely confined to contract specifications. New York prices for Prime Western are at the usual freight differential of 35c. per 100 lb. above St. Louis.

## Tin Down and Up

Tin in the domestic market stiffened last Thursday and Friday, suffered a decided drop on Monday, and then became firmer on Tuesday. The forward position touched 45.75c. on Monday, with spot at 46.00c. However, consumers and speculative shorts, as has happened before in the last month or two, felt that this was cheap and bought in fair volume.

## Silver Steady and Lower

Silver has gradually declined during the last week because of a falling off in demand. This may be accounted for in part by Chinese holidays on July 2 and 3. The market is fairly steady with no definite tendency and very little business doing.

*Mexican Dollars* (Old Mexican pesos): June 28th, 45½c.; 29th, 45⅜c.; June 30th and July 2d, 45¼c.; July 3d, 45c.; July 4th, holiday.

## Foreign Exchange

Closing cable quotations on Tuesday, July 3, were: Francs, 3.92$\frac{23}{32}$c.; lire, 5.25$\frac{5}{8}$c.; and marks, 23.87¾c. Canadian dollars ¼ per cent discount.

## Large Demand but Weak Prices for Steel and Iron

*Pittsburgh, July 3, 1928.*

WITH half the "Presidential year" gone, the steel trade has experienced no unfavorable influence, for the half year's steel production makes a new record, passing the first half of both 1927 and 1928 by about 3 per cent, and it enters the second half with a good momentum and with no stocks of steel in the hands of buyers. Production is at about 70 per cent, representing normal seasonal decline.

Heavy production of agricultural implements has been recorded in the half year. Fabricated structural steel bookings have run about 10 per cent ahead. Automobile production has been much above 1927 and only slightly below 1926. On the other hand, there is a loss in tubular goods, chiefly in oil- and gas-well casing and tubing. Railroad buying has been very light, but it was moderately light in 1926 and lighter in 1927.

Prospects are for rather dull conditions in the next three months, with a revival late in the year. Last year there was absolutely no improvement after July. Thus the prospect in the second half will be better than 1927, but possibly not so good as 1926.

Finished steel prices are not at all strong on the whole. Sheets and strips grew a trifle easier during June and now average slightly under their last low point, late in 1927. In bars, shapes, and plates the effort to establish 1.90c. as the third-quarter price proved no more than a gesture, the general market remaining at 1.85c., subject to shading in special cases. Semi-finished steel has been gradually yielding and is now quotable at a dollar a ton under prices ruling since early in 1927, putting the market at $32 for billets and slabs and $33 for sheet bars, f.o.b. maker's mill, Pittsburgh or Youngstown.

*Pig Iron*—Basic pig iron has had another sharp drop, a sale being made early in June at the equivalent of $15.25, Valley, and a subsequent sale at $15.75 seems to have been of special quality. For seven months up to May 1 the market had been $17. The decline is attributed to steel works' selling pig iron. Bessemer has held at $17, and foundry has dropped 25c. to $16.75, all f.o.b. Valley furnaces, with $1.76 freight to Pittsburgh.

*Connellsville Coke* — Furnace and foundry coke contracts have been renewed for third quarter, or second half in some foundry contracts, with no changes in prices or personnel. Spot prices remain at $2.65@$4.25 for foundry.

## Joplin District Producing Less Than Consumption

*Joplin, Mo., June 30, 1928*

**Blende**

| | Per Ton |
|---|---|
| High | $42.50 |
| Premium blende, basis 60 per cent zinc | $40.00@ 41.00 |
| Prime Western, basis 60 per cent zinc | 40.00 |
| Fines and slimes, 60 per cent zinc | 36.00@ 39.00 |
| Average settling price, all zinc | 39.73 |

**Galena**

| | |
|---|---|
| High | $84.70 |
| Basis 80 per cent lead | $82.50@ 83.50 |

Shipments for the week: Blende, 8,397; lead, 2,550 tons. Value, all ores the week, $547,130.

Shipments for six months: Blende, 398,100; lead, 46,848 tons. Value, all ores, six months, $15,119,570.

Several mines long idle have been reopened recently after several months of development work, but this increased production is likely to be offset by the closing of other mines either worked out or closing for repairs or exploration. Production continues below consumption.

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*Platteville, Wis., June 30, 1928*

| Zinc Blende | Per Ton |
|---|---|
| Blende, basis 60 per cent | $42.75 |
| **Lead Ore** | |
| Lead, basis 80 per cent lead | $81.00 |

Shipments for the week: Blende, 759 tons; lead, 45 tons. Shipments for the year: Blende, 18,859 tons; lead, 1,085 tons. Shipments for the week to separating plants, 1,190 tons blende.

## Other Metals

**Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.**

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, 9½c., for all positions. Market quiet. Cookson's "C" grade, spot, 15⅜c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $2.10. Smaller lots $2.25 and up. London 9s.

CADMIUM—Per lb., 65@75c. Active demand. London, 2s. 3d. for Australian metal.

COBALT—Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.50@$3. Black oxide, 70 per cent, $2.10. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $5.

IRIDIUM—Per oz., $280@$300 for 98 @99 per cent sponge and powder. Market nominal. London £55@£60.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM—Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x16 in.), 98c.; 3-lb. sticks (1⅛x33 in.), $0.95@$1; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. Market active. London 4s.@4s. 3d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per gram, 99 per cent, 4c. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.90 per cent grade), for single lots of spot metal. London, per long ton, £170@£175 according to quantity.

OSMIUM—Per oz., $65@$80; London, £15@£18.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. London £10¼@£11½. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74@$74.50 bid, $76@$76.50 asked. Market quiet.

London, per oz., £17@£17 2s. 6d. for refined; crude and scrap, nominal at £15 10s.@£16.

QUICKSILVER — Per 76-lb. flask, $121@$122. Market quiet. San Francisco wires $124. London easy at £22.

RADIUM — Per mg. radium content, $70.

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[1]Price furnished by Foote Mineral Co., Philadelphia.

RHODIUM—Per oz., $50@$60. Nominal.

RUTHENIUM — Per oz., $45@$60. Nominal.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c.; tantalum powder, 11c. Market firm.

TELLURIUM—Per oz., 15@18c.

[1]THALLIUM METAL—Per oz.: Ingot, 99 per cent pure, $1.06 in 25-lb. lots.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., 96 to 98c., depending on quantity. Market largely nominal.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

## Metallic Ores

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22@$23.50 for 47 to 50 per cent $Cr_2O_3$ ore. Prices firm.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 58 to 63 per cent, 8@8½c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 10@11c., nominal.

Spanish foundry or basic, 50@60 per cent, 8½@10c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9@9½c. Nominal.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 52@55 per cent, 38@40c.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent $MnO_2$, Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of combined $Ta_2O_5$ and $Cb_2O_5$, basis 65 per cent ore, $30.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent $TiO_2$, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 93 per cent concentrate, 10c. for 30-ton lots.

TUNGSTEN ORE—Per unit of $WO_3$, N. Y.: Wolframite, $10.75@$10.85. Western scheelite, $11@$11.25. Market quieter after period of activity.

ZIRCON ORE—Per net ton containing 55 per cent $ZrO_2$, f.o.b. Atlantic seaboard, $8 in 30-ton lots.

## Non-Metallic Minerals

**Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.**

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest:

Crude No. 1, $600@$650; crude No. 2, $375@$400; spinning fibers, $190@$225; magnesia and compressed sheet fibers, $160@$175; shingle stock, $55@$115, various grades; paper stock, $45@$50; cement stock, $25; short fibers, $10@$20; floats, $15. Market firm, demand good.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

*Georgia:* Barytes ore, crude (per long ton), $7. Washed and water floated to 97 per cent through 300 mesh, $19. Market fair, but showing effect of continued foreign competition.

*Missouri:* Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $6.50, f.o.b. mines. Market fair.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent $Al_2O_3$, 1.5 to 2.5 per cent $Fe_2O_3$, $7.50@$8, f.o.b. *Georgia* mines. Other grades, 56 to 59 per cent $Al_2O_3$, 5 to 8 per cent $SiO_2$, $7.50@$8.50 f.o.b. *Georgia-Alabama* mines. Pulverized and dried, $14; calcined, 78 to 84 per cent $Al_2O_3$, $18@$20.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent $Al_2O_3$, 1 to 3 per cent $SiO_2$, $4.80@$6.50; Istrian, 54 to 57 per cent $Al_2O_3$, 3 to 5 per cent $SiO_2$, $5.50@$7; French, 56 to 59 per cent $Al_2O_3$, 2 to 5 per cent $SiO_2$, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¾c.; granulated or powdered, 2½c.; f.o.b. plant, Pennsylvania.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York*, $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7: crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$15; ground, $7@$10.

*Florida*, pressed pottery, bulk, $13.50; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour, No. 1, $20; No. 2, $17. Market slow.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $45@$50.

DIATOMITE — Per short ton, f.o.b. plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder, $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45. Over 85 per cent silica, 98 per cent through 200 mesh, $25@$26, depending on quantity.

EMERY — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

*North Carolina*, per long ton, No. 1 pottery grade, crude, $5.50@$7.50; glass grades, $5@$6. Market fair.

*New Hampshire*, per ton: Pottery grade, $8. Best quality lump, $9.

*New York*, Per ton: f.o.b. cars, No. 1 crude, $9. Market quiet.

*Tennessee*, per ton: No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 140 mesh, $13.75; 200 mesh, $15.50; market slow.

*Maine*, per ton: Best pottery grade, ground, $19. Market fair.

FLUORSPAR—Per ton: F.o.b. *Kentucky* and *Illinois* mines.

Gravel, not less than 85 per cent $CaF_2$, and not over 5 per cent $SiO_2$, $16@$17. Foundry lump, 85-5, $18. Ground 95 to 98 per cent $CaF_2$, and not over 2½ per cent $SiO_2$, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Market quiet.

***New Mexico:*** 85-5 gravel, $16.50; 85-5 lump, $16.50; 94-3 lump, $21; 97-2 sacked, $30. Market fair.

Foreign spar, duty paid, $15.50@$16, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $14; 100 mesh up, $8; 200 mesh up, $14.

Powdered, import duty paid, $24@$25 per ton.

GARNET — Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots, f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50. Normal market.

GRAPHITE—Per lb.: F.o.b. *New York.*

Ceylon lump, 7½@8½c.; chip, 6½@7½c.; dust, 3@5c.; Madagascar flake, 6½@7½c. Market fair.

No. 1 flake, 10c. and up. No. 2 flake, 7c. and up. Foundry facings, 3c. and up. Amorphous and crystalline, fine ground, 3c. and up.

Crude amorphous graphite, $15@$30 per ton, according to grade.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $25.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.70@$3; ground, $4@$9; agricultural, $6@$9; calcined, $7@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, $1 up to $6 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $42; Grade B, $37.50; dead burned, $28, crude, $11. F.o.b. Eastern seaboard, calcined, $40. Market slow.

MICA—Per ton, f. o.b. plant:

*New Hampshire:* Mine run, $320; clean shop scrap, $25; mine scrap, $22.40. White dry ground, 20 mesh, $25; 40 mesh, $35; 60 mesh, $55; 100 mesh, $75; 200 mesh, $80. Market improving.

*North Carolina:* White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York*, duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c. Market slow.

[1]MONAZITE—Per ton: (Minimum 6 per cent $ThO_2$), $130.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market good.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

*Florida*, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent, $4. Prices firm.

*Florida*, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4. Market dull during summer months.

*Tennessee*, ground, 97 per cent through 200 mesh, 33 per cent $P_2O_5$, $9.50 per ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton).

POTASH—The ruling contract prices are as follows:

| | Bags | Bulk |
|---|---|---|
| Muriate of potash 80 @ 85 per cent, basis 80 per cent.... | 36.40 | 34.80 |
| Sulphate of potash 90 @ 95 per cent, basis 90 per cent.... | 47.30 | 45.70 |
| Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent ..... | 27.25 | 25.65 |
| Manure salt 30 per cent..... | 21.75 | 18.75 |
| Manure salt 20 per cent..... | 15.40 | 12.40 |
| Kainit 14 @ 16 per cent..... | 12.50 | 9.50 |
| Kainit 12.4 per cent..... | 12.00 | 9.00 |

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur, Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 40c. For optical purposes, double above prices; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per ton for domestic market, $18, f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

*Vermont:* 99 per cent through 200 mesh, extra white, $9.50@$10; 96½ to 98 per cent through 200 mesh, medium white, $8.50@$9.50; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks. Market weak.

*New York:* Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Demand fair.

*Georgia:* Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

*New Jersey:* Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream. $25: mill run, $15. Demand unusually active at present.

## Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent $Sb_2O_3$, 15½c. per lb.

ARSENIOUS OXIDE (White arsenic)—Per lb., 3¾@4c. Delivered near by. Most of lower priced arsenic has been absorbed. Quiet. London, per long ton, £17@£17½ quoted for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c.@$1, delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5.30@5.40c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude, in bags ex vessel, Atlantic ports, $2.15 for spot; future delivery, $2.17½@$2.22½.

[1]Price furnished by Foote Mineral Co., Philadelphia.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $10@$17.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅜c.

## Alloys

[1]FERROCERIUM—Per lb., $9 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. Spot shipments slightly higher. Freight allowed in carload lots east of Mississippi River and north of Baltimore.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105 for last half of 1928. Spiegeleisen, 19@21 per cent, $33 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.25.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $140; 14@17 per cent, $45. Quotations for spot shipments slightly higher. Market active.

FERROCARBONTITANIUM — Per ton: For 15 to 18 per cent material, $200, f.o.b. Niagara Falls, N. Y.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, 96@98c., f.o.b. works. Market strong.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, $3.15@$3.65, depending on grade and quantity. Market active.

MONEL METAL—Per lb. base price for shot, 28c., f.o.b. Huntington, W. Va.

NICKEL SILVER—29¾c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 20¼c. per lb.; rods, 17¼c. per lb.

## Rolled Metals

COPPER—Sheets, 23½c.; wire, 16⅝c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled, 10c. per lb.; clipped, 10¼c.

ZINC SHEETS — 9¼c. per lb., f.o.b. works.

## Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE BRICK—Per net ton, f.o.b. works: 9-in. straights, $65.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio*, $43; *Alabama*, $51; *Illinois*, $52.

[1]ZIRKITE—Per lb.: Powdered, 80 per cent $ZrO_2$, 3½c. Brick, straights, 80c.@$1 each.

# Mining Stocks—Week Ended June 30, 1928

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Anaconda | New York | 69⅛ | 63⅜ | 68⅛ | Jl.14, Au. 20 Q | 1.00 |
| Ariz. Com'l | Boston | 5 | 4½ | 4½ | Ja. 19, Ja. 31 SA | 0.25 |
| Cal. & Ariz | New York | 100⅛ | 93⅜ | 98 | Je. 8, Je. 25 Q | 1.50 |
| Calumet & Hecla | Boston | 22½ | 22 | 22½ | My. 31, Je. 15 Q | 0.50 |
| Cerro de Pasco | New York | 78⅜ | 69 | 77⅛ | Ap.12, My.1 Q | 1.00 |
| Chile Copper | New York | 45⅛ | 43⅞ | 44⅛ | Je.6, Je.30 Q | 0.62½ |
| Con. Coppermines | N. Y. Curb | 12 | 11½ | 12 | | |
| Copper Range | Boston | 18½ | 17½ | 18 | Mr. 24, Ap. 20 A | 1.00 |
| Crystal Copper | Boston Curb | *50 | *40 | *44 | | |
| East Butte | Boston | 2⅜ | 2⅜ | 2⅜ | Dec., 1919 | 0.50 |
| Granby Consol | New York | 54⅜ | 51⅜ | 53⅜ | Jl.13, Au.1 Q | 1.00 |
| Greene Cananea | New York | 107½ | 94½ | 104½ | Je. 15, Jl. 2 | 1.00 |
| Howe Sound | New York | 60⅜ | 57½ | 60 | Je.30, Jl.16, Q | 1.00 |
| Inspiration Consol | New York | 22⅜ | 20 | 21⅜ | Apr. 1927 Q | 0.25 |
| Isle Royale | Boston | 18 | 16½ | 17½ | Fe.28, Mr.15 SA | 0.50 |
| Kennecott | New York | 90⅞ | 87½ | 90½ | Jl. 1, Jl. 2 Q | 1.25 |
| Magma Copper | New York | 53⅛ | 48½ | 52½ | Jl.29, Jl.16 Q | 0.75 |
| Mason Valley | N. Y. Curb | | | 1⅜ | | |
| Miami Copper | New York | 20⅛ | 19¼ | 20 | Au.1, Au.15, Q | 0.37½ |
| Mohawk | Boston | 58 | 55 | 57½ | Ap. 30, Je. 1 Q | 1.00 |
| Montana-Idaho | Spokane | *25 | *23 | *24 | | |
| Mother Lode Coal | New York | 2⅜ | 2½ | 2½ | Je.8, Je. 30, SA | 0.15 |
| Nevada Consol | New York | 23 | 21⅜ | 22⅜ | Je.15, Je.30 Q | 0.375 |
| New Cornelia | Boston | 29 | 27½ | 27⅝ | My. 4, My. 21 Q | 0.50 |
| Noranda | N. Y. Curb | 47½ | 37 | 47 | | |
| North Butte | Boston | 2⅜ | 2¼ | 2⅜ | Oct., 1918 | 0.25 |
| Ohio Copper | N. Y. Curb | *90 | *75 | *82 | Sept., 1926 | 0.03 |
| Old Dominion | Boston | 12 | 11 | 12 | Dec., 1918 | 1.00 |
| Phelps Dodge | N. Y. Curb | 136 | 135 | 135 | Je.25, Jl.22 Q | 2.00 |
| Quincy | Boston | 32 | 29½ | 31½ | March, 1920 | 1.00 |
| St. Mary's Min. Ld | Boston | 30 | 28 | 29 | Ap.1928 A | 2.00 |
| Seneca Copper | New York | 2⅞ | 2⅜ | 2⅜ | | |
| Shattuck-Denn | N. Y. Curb | 15½ | 14½ | 15 | | |
| Tenn. C. & C | New York | 14½ | 13¾ | 14⅛ | My.29, Je.15,Q | 0.12½ |
| United Verde Ex | N. Y. Curb | 14⅜ | 14 | 14⅜ | July 6, Q | 0.50 |
| Utah Copper | New York | 158 | 158 | 158 | Je.15, Je.30 Q | 1.50 |
| Utah Metal & T | Boston | 1⅛ | 1 | 1⅛ | Dec., 1917 | 0.30 |
| Walker Mining | Salt Lake | 1.35 | 1.17 | 1.32½ | | |
| **NICKEL-COPPER** | | | | | | |
| Internat. Nickel | New York | 95⅜ | 89 | 93 | Je.14, Je.30 Q | 0.50 |
| Internat. Nickel pfd | New York | 115½ | 114½ | 115¼ | Ap.12, My.1 Q | 1.50 |
| **LEAD** | | | | | | |
| Gladstone Mtn | Spokane | *3¼ | *2⅛ | *3⅛ | June, 1927 | 0.005 |
| National Lead | New York | 124 | 117½ | 124 | Je.15, Je.30 Q | 1.25 |
| National Lead, pfd. A | New York | | | 146 | Je.1, Je.15 Q | 1.75 |
| National Lead, pfd. B | New York | 120 | 120 | 120 | Jl. 20, Au. 1 Q | 1.50 |
| St. Joseph Lead | New York | 43 | 41 | 42⅛ | Je.9, Je.20, QX | 0.75 |
| **ZINC** | | | | | | |
| Am. Z. L. & S | New York | 24⅜ | 23 | 24⅜ | May, 1917 | 1.00 |
| Am. Z. L. & S. pfd | New York | 84½ | 82 | 84½ | Nov., 1920 | 1.50 |
| Butte C. & Z | New York | 7⅞ | 6⅜ | 7⅜ | De., 1926 | 0.50 |
| Butte & Superior | New York | 12⅛ | 11½ | 12 | Je.15,Je.30 Q | 0.50 |
| Callahan Zn-Ld | New York | 3¼ | 3 | 3⅛ | De., 1920 | 0.50 |
| Consol.Lead&Zinc 'A' | St. Louis | 14 | 13¼ | 13⅜ | Je.25, Jl.1 Q | 0.25 |
| Eagle-Picher | Cincinnati | 17½ | 16⅜ | 17 | No.15, De.1 Q | 0.40 |
| Eagle-Picher pfd | Cincinnati | 100 | 100 | 100 | Mr. 31, Ap. 16 Q | 1.50 |
| New Jersey Zn | N. Y. Curb | 217 | 211 | 214 | Jl. 20, Au. 10 X | 2.00 |
| Treadwell-Yukon | Toronto | 18.50 | 18.50 | 18.50 | | |
| United Zinc | N. Y. Curb | *75 | *75 | *75 | | |
| Yellow Pine | Los Angeles | *47½ | *47½ | *47½ | Dec., 1925 QX | 0.04 |
| **GOLD** | | | | | | |
| Alaska Juneau | New York | 3⅛ | 3¼ | 3¼ | | |
| Ankerite | Toronto | *35 | *35 | *35 | | |
| Barry-Hollinger | Toronto | *71 | *50 | *60 | | |
| Central Manitoba | Toronto | 1.23 | 1.13 | 1.15 | | |
| Cresson Consol. G | N. Y. Curb | 1⅜ | 1 1/16 | 1 1/16 | Je.30, Jl.10 Q | 0.10 |
| Dome Mines | New York | 8⅜ | 8⅛ | 8⅛ | Je.30, Jl.20 Q | 0.25 |
| Golden Cycle | Colo.Springs | †1.75 | †1.67 | | My. 31, Je.10 Q | 0.04 |
| Gold Hill | Toronto | *1 1/4 | *10 | *11 | | |
| Hollinger Consol | Toronto | 14.00 | 13.40 | 13.75 | Je.27, Jl.14 FW | 0.10 |
| Homestake Mining | New York | 73 | 73 | 73 | Je.20, Je.25 M | 0.50 |
| Kirkland Lake | Toronto | 1.78 | 1.50 | 1.52 | | |
| Lake Shore | Toronto | 23.15 | 22.15 | 22.50 | Je.1, Je.15 QX | 0.20 |
| McIntyre Porcupine | New York | 26⅛ | 24½ | 24½ | May1, Je.1 Q | 0.25 |
| Portland | Colo.Springs | †*17 | †*15 | | Ap., 1927 | 0.02 |
| Rand Mines | New York | | | 39½ | Fe.21-28 Am.Sh. | 1.52 |
| Sylvanite | Toronto | 2.90 | 2.10 | 2.55 | | |
| Teck-Hughes | Toronto | 11.20 | 10.55 | 10.85 | Jl. 17, Au. 1 SAX | 0.15 |
| Tom Reed | Los Angeles | *45½ | *40 | *40 | Dec., 1926 | 0.02 |
| Tough-Oakes | Toronto | *27½ | *25 | *26 | | |
| Vipond Cons | Toronto | *55 | *52 | *52 | April, 1927 | 0.03 |
| Wright-Hargreaves | Toronto | 4.25 | 3.80 | 3.90 | Ap.13, My.1 Q | 0.05 |
| **GOLD AND SILVER** | | | | | | |
| Carnegie Metals | N. Y. Curb | 20 | 19 | 19⅞ | | |
| Con. Cortez | N. Y. Curb | *28 | *28 | 28 | | |
| Dolores Esperanza | N. Y. Curb | 1¼ | 1 | 1 1/16 | July, 1923 | 0.05 |
| N.Y. Hond's Rosario | N. Y. Curb | | | 15 | Ap.18, Ap.28 Q | 0.50 |
| Premier Gold | N. Y. Curb | 2 1/16 | 2 1/16 | 2⅜ | Je.14, Jl.3 | 0.06 |
| Tonopah Belmont | N. Y. Curb | 1 | 1 | 1 | Oc., 1925 | 0.05 |
| Tonopah Extension | N. Y. Curb | *13 | *12 | *12 | Ap., 1925 | 0.05 |
| Tonopah Mining | N. Y. Curb | | | 4 | Mar.31, Ap.21 SA | 0.07½ |
| West End Consol | N. Y. Curb | | | *4 | Mar., 1923 | 0.05 |
| Yukon Gold | Boston Curb | *64 | *56 | *64 | June, 1918 | 0.02 |
| **SILVER** | | | | | | |
| Beaver Consol | Toronto | 1.19 | 1.00 | 1.00 | May, 1920 | 0.03 |
| Castle-Trethewey | Toronto | *58 | *55 | *55 | | |
| Coniagas | Toronto | | | 4.65 | May, 1924 | 0.12½ |
| Keeley | Toronto | *62 | *61 | *61 | Mr.1, Mr.15 SA | 0.04 |
| Lorrain Trout Lake | Toronto | | | *50 | July, 1925 | 0.05 |
| Mining Corp. Can | Toronto | 3.45 | 3.20 | 3.25 | My.20, Je.13 SA | 0.125 |
| Nipissing | N. Y. Curb | 4 | 3¾ | 4 | Je.30, Jl.20Q | 0.075 |

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **SILVER-LEAD** | | | | | | |
| Ahumada | New York | 3⅞ | 3½ | 3⅝ | Ap., 1927 | 0.12½ |
| Bingham Mines | Boston | 45 | 41½ | 42½ | Je.23, Jl.5 Q | 1.00 |
| Bunker Hill & Sullivan | N. Y. Curb | 123 | 122½ | 123 | June 10, MX | 0.75 |
| Cardiff M. & M | Salt Lake | | | *70 | Feb. 5, 1927 | 0.10 |
| Chief Consol | Salt Lake | 4.45 | 4.25 | 4.45 | Ja.10, Fe.1 K | 0.10 |
| Consti'n Mng.&Mill'g. | Spokane | *15 | *.5 | *15 | | |
| Erupcion | Boston Curb | *28 | *28 | *28 | Dec. 13, Jan. 3, | 0.07½ |
| Eureka Lily | Salt Lake | 2.20 | 2.15 | 2.17½ | | |
| Federal M. & S | New York | 125 | 125 | 125 | Je., 1927 | 10.00 |
| Federal M. & S. pfd | New York | | | 98⅜ | My.25, Je.15 Q | 1.75 |
| Hecla Mining | N. Y. Curb | 14⅜ | 14 | 14⅜ | My.15, Je.15 Q | 0.15 |
| Highland-Surprise | Spokane | *12½ | *12 | *12½ | | |
| Iron King Mining | Salt Lake | *88 | *79 | *79 | | |
| Keystone Mining | Salt Lake | *27 | *27 | *27 | Fe., 1926 | 0.07½ |
| Lucky Jim | Spokane | *31 | *26 | *31 | | |
| Lucky Tiger-Com | Kansas City | †7.85 | †7.70 | | Je.7, Je.20 MX | 0.07 |
| Mammoth Mining | Salt Lake | | | 1.40 | De., 1926 | 0. 25 |
| North Lily | Salt Lake | 7.60 | 7.40 | 7.60 | | |
| Park Utah | New York | 11⅞ | 11 | 11⅞ | Je.15, Jl.2 Q | 0.20 |
| Plutus Mining | Salt Lake | 2.00 | 2.00 | 2.00 | Ap.10, Ap. 16 Q | 0.10 |
| Rico-Argentine | Salt Lake | *51 | *51 | *51 | June 15 | 0.03 |
| Silver King Coal | Salt Lake | 11.50 | 11.25 | 11.50 | Je.20, Jl.2 Q | 0.25 |
| Silversmith | Spokane | *14⅜ | *13½ | *14 | Oct., 1926 Q | 0.02 |
| Strattons Mines | Spokane | *74 | *70 | *74 | | |
| Sunshine M. Co | Spokane | 1.35 | 1.20 | 1.20 | June 20, | 0.02 |
| Tamarack-Custer | Spokane | *49 | *40 | *49 | Sept., 1924 | 0.25 |
| Tintic Standard | Salt Lake | 14.00 | 14.00 | 14.00 | Je.18, Je.30 QX | 0.30 |
| Utah-Apex | Boston | 4 | 3⅞ | 3⅞ | Jl.14, Au.1 1926 | 0.25 |
| **IRON** | | | | | | |
| Bethlehem Steel | New York | 56 | 53 | 55⅞ | Jl., 1924 | 1.25 |
| Cleveland-Cliffs Iron | Cleveland | 110 | 104½ | 109 | Ap.13, Ap. 25. Q | 1.00 |
| Colorado Fuel & Iron | New York | 58⅞ | 52½ | 58½ | May, 1921 | 0.75 |
| Gt. North'n Iron Ore | New York | 20½ | 19½ | 20½ | Ap. 9, Ap. 30 K | 0.75 |
| Inland Steel | New York | 55 | 53 | 55 | My. 15, Je.1 Q | 0.62½ |
| Republic I. & S | New York | 52⅜ | 49⅜ | 52 | My.15, Je.1 Q | 1.00 |
| Republic I. & S. pfd | New York | 104 | 102 | 104 | Je. 15, Jl. 2 Q | 1.75 |
| Sloss-Sheffield S. & I | New York | 103½ | 102 | 103½ | Je.9, Je.20 Q | 1.50 |
| Sloss-Shef. S.&I. pfd | New York | | | 115½ | Je. 20, Jl. 2 Q | 1.75 |
| U. S. Steel | New York | 138⅜ | 132⅜ | 137⅜ | My.31, Je.29 Q | 1.75 |
| U. S. Steel, pfd | New York | 141⅞ | 141½ | 141½ | Ap. 30, My. 29 Q | 1.75 |
| Virginia I. C. & C | New York | | | 14½ | Jan., 1924 | 1.50 |
| Virginia I.C.&C. pfd | New York | | | 55 | Je. 16, Jl. 2 SA | 2.50 |
| **DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN** | | | | | | |
| De Beers Consol | New York | 25⅜ | 15⅝ | 25⅜ | July., 1927 | 1.45 |
| So. Am. G. & P. New | N. Y. Curb | 3½ | 3 | 3 | | |
| Alum. Co. of Amer | N. Y. Curb | 150 | 135 | 150 | | |
| Alum. Co. of Amer. pf. | N. Y. Curb | 109½ | 107½ | 108⅜ | Je. 15, Jl. 1 Q | 1.50 |
| Vanadium Corp | New York | 74½ | 66½ | 72½ | My. 1, My. 15 Q | 0.75 |
| Patino M. & E | New York | 30½ | 28 | 30 | April, 1928 | 4s. |
| **ASBESTOS** | | | | | | |
| Asbestos Corp | Montreal | 30½ | 30 | 30½ | Jan., 1926 | 1.50 |
| Asbestos Corp. pfd | Montreal | 93 | 91 | 92 | Jl. 30, Jl. 16 Q | 1.75 |
| **SULPHUR** | | | | | | |
| Freeport Texas | New York | 68½ | 64 | 68½ | Jl.14, Au.1 QX | 1.75 |
| Texas Gulf | New York | 67⅜ | 63¾ | 63¾ | Je.1, Je.15 Q | 1.00 |
| **MINING, SMELTING, REFINING AND GENERAL** | | | | | | |
| Amer. Metal | New York | 48½ | 45⅜ | 48½ | Au. 21, Se.1 Q | 0.75 |
| Amer. Metal, pfd. 6% | New York | | | 113 | Au.15, Se.1 Q | 1.50 |
| Amer. Met. pfd. 7% | New York | | | 125 | My.15, Je.1 | 1.75 |
| Amer. Sm. & Ref | New York | 196 | 186½ | 191⅜ | Jl 13, Au.1 | 2.00 |
| Amer. Sm. & Ref. pfd | New York | 136½ | 135 | 136½ | Au. 3, Se. 1 Q | 1.75 |
| Consol. M. & S | Montreal | 263½ | 258 | 263 | Je.30, Jl.16 SAX | 6.25 |
| Newmont Mining | N. Y. Curb | 160⅜ | 150½ | 158½ | Je.30, Jl.16 Q | 1.00 |
| U. S. Sm. R. & M | New York | 49⅜ | 45½ | 48⅛ | Jl. 5, Jl. 14 Q | 0.87½ |
| U.S. Sm. R.&M. pfd | New York | 54½ | 53⅛ | 53⅛ | Jl. 5, Jl. 14 Q | 0.87½ |

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

**LONDON QUOTATIONS—WEEK ENDED June 19, 1928**

| Name | High | Low | Last | Date | Amount | Last Div. |
|---|---|---|---|---|---|---|
| Alaska Mexican ($5) | 37/6 | 37/— | 37/6 | | | |
| Alaska Treadwell ($25) | 125/— | 120/— | 120/— | Nov., 1926 | 4 (d) | |
| Aramayo Mines (25 frs.) | 67/6 | 63/1½ | 65/— | May, 1928 | 5 p.c. (†) | |
| Burma Corpn. (10 rupees) | 14/4½ | 13/9 | 14/— | Aug., 1928 | 6 annas* | |
| Bwana M'Kubwa (5s) | 5/— | 4/8¼ | 4/9 | | | |
| Camp Bird (2s) | 4/7½ | 4/3 | 4/6 | April, 1928 | 16⅔ p.c. | |
| El Oro (£1) | 4/9 | 4/6 | 4/7½ | Nov., 1924 | 2½ p.c.* | |
| Frontino & Bolivia (£1) | 12/9 | 12/3 | 12/6 | Jan., 1928 | 5 p.c. | |
| Mexican Corpn.(£1) | 11/3 | 11/— | 11/— | | | |
| Mexico Mines of El Oro (£1) | 30/7½ | 28/9 | 30/— | Dec., 1926 | 5⅓ p.c.* | |
| Mond Nickel | 180 | 168 1½ | 171/3 | Feb., 1928 | 7½ p.c. | |
| N'Changa Copper Mining | 16/— | 15/— | 16/— | | | |
| Oroville Dredging (£1) | 4/— | 3/7½ | 3/9 | Dec., 1923 | 3¾ p.c. | |
| Rhodesian Congo Border (£1) | 37/6 | 30/— | 33/9 | | | |
| St. John del Rey (£1) | 12/9 | 12/— | 12/6 | April, 1928 | 7½ p.c. | |
| San Francisco Mines (10s) | 28 | — 27/3 | 27/6 | July 1928 | 12½s. | |
| Santa Gertrudis (£1) | 16/10½ | 16/3 | 16/3 | July 1928 | 7½ p.c. | |
| Selukwe (2s. 6d.) | 14/1½ | 13/1½ | 13/7½ | April, 1917 | 6¼ p.c. | |
| S. Amer. Copper (2s.) | 2/9 | 2/3 | 2/7½ | Nov., 1917 | 75 p.c. | |
| Tanganyika (£1) | 60/— | 56/10½ | 58/1½ | Aug., 1927 | 7½ p.c. | |
| Union Miniere de Haut-Katanga (Brussels) | 11,550 | 11,000 | 11,525 | July, 1927 | 182.60 (‡) | |

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.